Tx 11843

INSTALLATION RESTORATION PROGRAM

PHASE I – RECORDS SEARCH

DYESS AFB, TEXAS

~~TX3571924643~~

X-Ref SA Vol I

PREPARED FOR

UNITED STATES AIR FORCE STRATEGIC AIR COMMAND

Deputy Chief of Staff

Engineering and Services

Offutt AFB, Nebraska 68113

JULY 1985

ES ENGINEERING-SCIENCE

NOTICE

This report has been prepared for the United States Air Force by Engineering-Science for the purpose of aiding in the Air Force Installation Restoration Program. It is not an endorsement of any product. The views expressed herein are those of the contractor and do not necessarily reflect the official views of the publishing agency, the United States Air Force, nor the Department of Defense.

Copies of the report may be purchased from:

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Federal Government agencies and their contractors registered with Defense Technical Information Center should direct requests for copies of this report to:

Defense Technical Information Center
Cameron Station
Alexandria, Virginia 22314

INSTALLATION RESTORATION PROGRAM
PHASE I: RECORDS SEARCH
DYESS AFB
TEXAS

TX3571924643
X-Ref SA Vol 1

Prepared For

United States Air Force
STRATEGIC AIR COMMAND
Deputy Chief of Staff
Engineering and Services
Offutt AFB, Nebraska 68113

July 1985

Prepared By

ENGINEERING-SCIENCE
57 Executive Park South, Suite 590
Atlanta, Georgia 30329

NOTICE

This report has been prepared for the United States Air Force by Engineering-Science for the purpose of aiding in the Air Force Installation Restoration Program. It is not an endorsement of any product. The views expressed herein are those of the contractor and do not necessarily reflect the official views of the publishing agency, the United States Air Force, nor the Department of Defense.

Copies of the report may be purchased from:

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Federal Government agencies and their contractors registered with Defense Technical Information Center should direct requests for copies of this report to:

Defense Technical Information Center
Cameron Station
Alexandria, Virginia 22314

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

LIST OF FIGURES

LIST OF FIGURES
(Continued)

LIST OF TABLES

LIST OF TABLES
(Continued)

EXECUTIVE SUMMARY

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material disposal sites on DOD property, to control the migration of hazardous contaminants, and to control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases consisting of Phase I, Installation Assessment/Records Search; Phase II, Confirmation/Quantification; Phase III, Technology Base Development; and Phase IV, Operations/Remedial Actions. Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I, Initial Assessment/Records Search for Dyess Air Force Base (AFB) under Contract No. F08637 84 C0070.

INSTALLATION DESCRIPTION

Dyess AFB is located in the City of Abilene and Taylor County, Texas. The main base has an area of 5,216 acres. Six nearby communications and navigational aid annexes exist including a receiver, transmitter, two middle markers and two ceilometers.

The current installation site was Tye Army Airfield during World War II and then abandoned until 1952 when Dyess AFB was approved for construction as a Strategic Air Command (SAC) base. The base became active under SAC in 1955-1956. From 1961 to the present, troop carrier activities have also existed at the base, first under the Tactical Air Command (TAC) and later under the Military Airlift Command (MAC). Numerous large multi-engined aircraft bombers, tankers, troop/cargo carriers have been stationed at the base since it began operations.

ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation identified the following points relevant to Dyess AFB:

- The mean annual precipitation is 25.3 inches and net annual precipitation is calculated to be minus 43 inches.
- Localized flooding may occur on the base in the areas adjacent to the North Diversion Ditch and Little Elm Creek (South Diversion Ditch).
- Wetlands (North and South Diversion Ditches) have been identified on the installation.
- Base upland surface soils are predominantly clayey and possess low permabilities. They are underlain by more permeable sand and gravel. Soils present in the channels of base streams are silty sands and are somewhat more permeable. Extensive sand and gravel zones probably underlie the stream channel materials.
- Two aquifers of minor importance probably exist on base. A shallow aquifer, present at or near land surface, is composed of a basal sand and gravel in upland clayey sediments and a sand and gravel zone is likely present in the lower extent of stream channel alluvium. A bedrock aquifer also underlies the base.
- Shallow aquifer ground water was encountered at the base hospital at a depth of some sixteen feet below land surface. The depth to water in the deep (rock) aquifer is unknown.
- The shallow aquifer (and probably the deep aquifer) receive recharge from precipitation or infiltration through streambeds within the base boundaries.
- All of the water-bearing zones identified on base probably communicate hydraulically to some degree. During periods when area water levels are highest, the shallow aquifer likely discharges (provides base flow) to local streams.
- The shallow aquifer identified on base has been reported to be a source of water supplies to two consumers located one mile downstream (down gradient) from Dyess AFB.

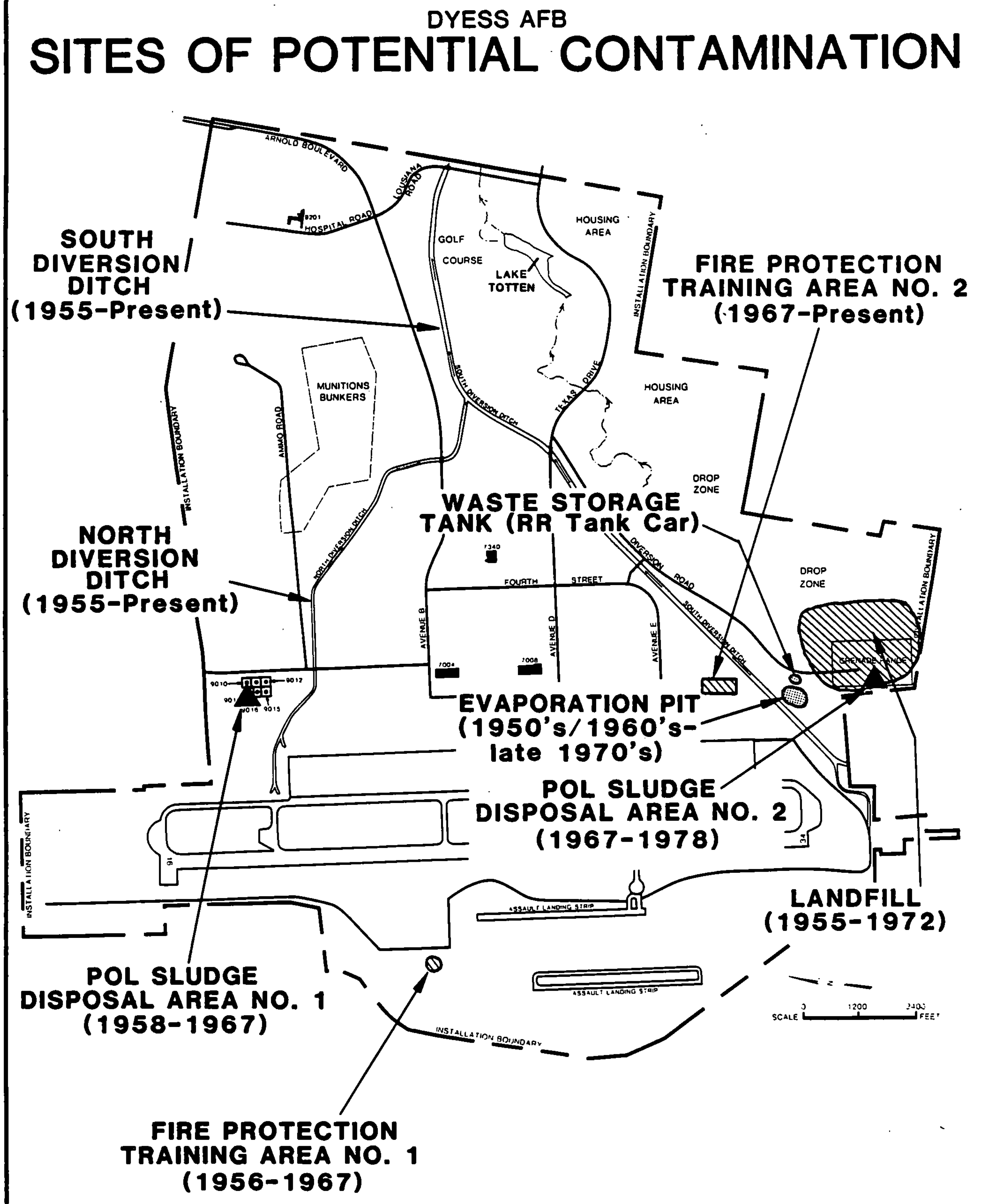
- The vast majority of study area consumers, both institutional and individual, obtain potable water supplies from the City of Abilene municipal system. The Abilene system obtains its water supplies from several lakes and reservoirs. Lake Fort Phantom Hill, located ten miles northeast of the base, is; the principal source of supply. The reservoir potentially receives some base drainage via Little Elm Creek and Elm Creek.
- Historic water quality data indicates that base surface water conforms to the standard required for the designated use classifications of local streams.
- Little Elm Creek and its unnamed tributaries on base are ephemeral streams; they contain moving water only when sufficient runoff is available to support flow.
- The Peregrine Falcon, a rare and endangered animal species, has been reported to be a periodic transient at the base.

METHODOLOGY

During the course of this project, interviews were conducted with installation personnel (past and present) familiar with past waste disposal practices; file searches were performed for past hazardous waste activities; interviews were held with local, state and federal agencies; and field surveys were conducted at suspected past hazardous waste activity sites. Nine sites (Figure 1) were initially identified as potentially containing hazardous contaminants and having the potential for contaminant migration resulting from past activities. These sites have been assessed using a Hazard Assessment Rating Methodology (HARM) which takes into account factors such as site characteristics, waste characteristics, potential for contaminant migration and waste management practices. The details of the rating procedure are presented in Appendix G and the results of the assessment are given in Table 1. The rating system is designed to indicate the relative need for follow-up investigation.

FINDINGS AND CONCLUSIONS

The following conclusions have been developed based on the results of the project team field inspection, reviews of base records and files, interviews with base personnel, and evaluations using the HARM system.



SOURCE: INSTALLATION DOCUMENTS

TABLE 1
SITES EVALUATED USING THE
HAZARD ASSESSMENT RATING METHODOLOGY
AT DYESS AFB

Rank	Site	Operation Period	HARM Score(1)
1	Evaporation Pit/Waste Storage Tank	1950's/1960's - late 1970's	62
2	North Diversion Ditch	1955 - Present	54
3	Fire Protection Training Area No. 2	1967 - Present	52
4	Fire Protection Training Area No. 1	1956 - 1967	50
5	Landfill/POL Sludge Disposal Area No. 2	1955 - 1972(2) 1967 - 1978(3)	48
6	South Diversion Ditch	1955 - Present	47
7	POL Sludge Disposal Area No. 1	1958 - 1967	46

(1) This ranking was performed according to the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.
(2) Landfill
(3) POL Sludge Disposal Area

The areas found to have sufficient potential to create environmental contamination are as follows:

- o Evaporation Pit/Waste Storage Tank
- o North Diversion Ditch
- o Fire Protection Training Area No. 2
- o Fire Protection Training Area No. 1
- o Landfill/POL Sludge Disposal Area No. 2

The areas judged to have minimal potential to create environmental contamination are as follows:

- o South Diversion Ditch
- o POL Sludge Disposal Area No. 1

RECOMMENDATIONS

A program for proceeding with Phase II and other IRP activities at Dyess AFB is presented in Section 6. The recommended actions include a soil boring, monitoring well, sampling and analysis program to determine if contamination exists. This program may be expanded to define the extent and type of contamination if the initial step reveals contamination. The Phase II recommendations are summarized in Table 2.

TABLE 2
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP
AT DYESS AFB

Site (Rating Score)	Recommended Monitoring Program
Evaporation Pit/Waste Storage Tank (62) and Landfill/POL Sludge Disposal Area No 2 (48)	Obtain one test boring at the site. Perform a geophysical survey using electromagnetic conductivity techniques to define the limits of the evaporation pit. Conduct a magnetometer survey of the evaporation pit site to identify areas where drums are buried. Perform a site specific hydrogeological study of the evaporation pit-landfill area. Locate and install 2 upgradient (background) wells and 12 to 14 wells downgradient of the evaporation pit-landfill area. Construct the wells with Schedule 40 PVC and screen them at least 10 ft. into the upper aquifer. Allow the screen to extend above the water table to collect any floating materials. Obtain four downstream samples (at surface and 4.0 ft. deep) in the South Diversion Ditch at approximately 1,000 ft intervals starting from the evaporation pit area. Fill and compact sample holes with clay. Sample and analyze the ground water and sediment samples for the parameters in Table 6.2.

TABLE 2
(Continued)
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP
AT DYESS AFB

Site (Rating Score)	Recommended Monitoring Program
North Diversion Ditch (54)	Obtain about six sediment samples at the surface and 4.0 ft. deep from the North Diversion Ditch. Take four samples at approximately 1,000 ft. intervals near the flightline discharges and the remaining two spaced evenly to the confluence with the South Diversion Ditch. Fill and compact the sample holes with clay. Analyze the sediment samples for the parameters listed in Table 6.2.
Fire Protection Training Area No. 2 (52)	Obtain one test boring about 30 ft. deep at the site. Conduct an electri cal resistivity survey of the site. Utilize the geophysics data and test boring data to confirm the continuity of the site geology and to assist in finalizing monitoring well locations. Install one upgradient and three downgradient monitoring wells. Construct the wells with Schedule 40 PVC and screen them at least 10 ft. into the upper aquifer. Allow the screen to extend above the water table to collect any floating materials. Sample and analyze the ground water for the parameters in Table 6.2.
Fire Protection Training Area No. 1 (50)	Obtain four soil borings (one control) 10 ft. deep or to the water table if it is less than 10 ft. Analyze the soil every 2 ft. for the parameters listed in Table 6.2.

Source: Engineering-Science

SECTION 1

INTRODUCTION

BACKGROUND AND AUTHORITY

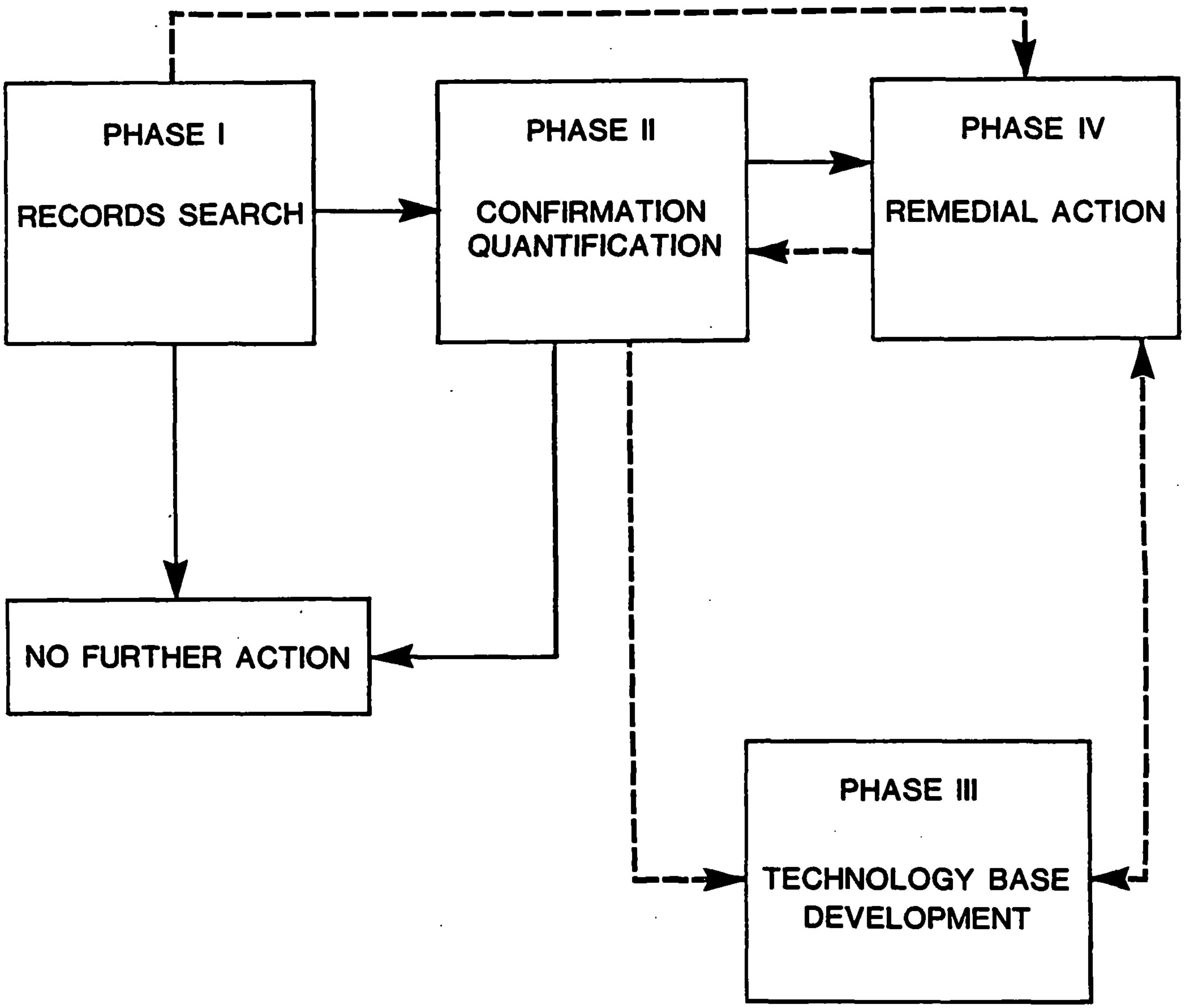
The United States Air Force, due to its primary mission of defense of the United States, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of past disposal sites and take action to eliminate hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Section 6003 of the Act, Federal agencies are directed to assist the Environmental Protection Agency (EPA) and under Section 3012, state agencies are required to inventory past disposal sites, and Federal agencies are required to make the information available to the requesting agencies. To assure compliance with these hazardous waste regulations, the Department of Defense (DOD) developed the Installation Restoration Program (IRP). The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the Installation Restoration Program. DOD policy is to identify and fully evaluate suspected problems associated with past hazardous contamination, and to control hazards to health and welfare that resulted from these past operations. The IRP is the basis for response actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, clarified by Executive Order 12316. CERCLA is the primary legislation governing remedial action at past hazardous waste disposal sites.

PURPOSE AND SCOPE

The Installation Restoration Program is a four-phased program (Figure 1.1) designed to assure that identification, confirmation/quantification, and remedial actions are performed in a timely and cost-effective manner. Each phase is briefly described below:

- Phase I - Installation Assessment/Records Search - Phase I is to identify and prioritize those past disposal sites that may pose a hazard to public health or the environment as a result of contaminant migration to surface or ground waters, or have an adverse effect by its persistence in the environment. In this phase it is determined whether a site requires further action to confirm an environmental hazard or whether it may be considered to present no hazard at this time. If a site requires immediate remedial action, such as removal of abandoned drums, the action can proceed directly to Phase IV. Phase I is a basic background document for the Phase II study.
- Phase II - Confirmation/Quantification - Phase II is to define and quantify, by preliminary and comprehensive environmental and/or ecological survey, the presence or absence of contamination, the extent of contamination, waste characterization (when required by the regulatory agency), and to identify sites or locations where remedial action is required in Phase IV. Research requirements identified during this phase will be included in the Phase III effort of the program.
- Phase III - Technology Base Development - Phase III is to develop a sound data base upon which to prepare a comprehensive remedial action plan. This phase includes implementation of research requirements and technology for objective assessment of adverse effects. A Phase III requirement can be identified at any time during the program.
- Phase IV - Operations/Remedial Actions - Phase IV includes the preparation and implementation of the remedial action plan.

U.S. AIR FORCE INSTALLATION RESTORATION PROGRAM



SOURCE: AFESC

Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I Records Search at Dyess AFB under Contract No. FO8637 84 C0070. This report contains a summary and an evaluation of the information collected during Phase I of the IRP and recommended follow-on actions. The approximate land area included as part of the Dyess AFB study is as follows:

Main Base	-	5,216 acres
Receiver Annex	-	40 acres
Transmitter Annex	-	20 acres
Middle Marker Annexes (2)	-	0.2 acres
Ceilometer Annexes (2)	-	0.5 acres

The activities performed as a part of the Phase I study scope included the following:

- Review of site records
- Interviews with personnel familiar with past generation and disposal activities
- Survey of types and quantities of wastes generated
- Determination of past hazardous waste treatment, storage, and disposal activities
- Description of the environmental setting at the base
- Review of past disposal practices and methods
- Reconnaissance of field conditions
- Collection of pertinent information from federal, state and local agencies
- Assessment of the potential for contaminant migration
- Development of recommendations for follow-on actions

ES performed the on-site portion of the records search during March 1984. The following team of professionals were involved:

- R. L. Thoem, Environmental Engineer and Project Manager, M.S., Sanitary Engineering, 21 years of professional experience.

- J. R. Absalon, Hydrogeologist, B.S. Geology, 10 years of professional experience.

- T. R. Harper, Environmental Scientist, B.S., Chemistry and Microbiology, 2 years of professional experience.

More detailed information on these three individuals is presented in Appendix A.

METHODOLOGY

The methodology utilized in the Dyess AFB Records Search began with a review of past industrial operations conducted at the installation. Information was obtained from available records such as shop files and real property files, as well as interviews with 93 past and present base employees from various operating areas. Those interviewed included current and past personnel associated with civil engineering, fuels management, roads and grounds maintenance, entomology, fire protection, real property, DPDO, history, field maintenance, munitions maintenance, avionics maintenance, organizational maintenance, and transportation. A listing of interviewee positions with approximate years of service is presented in Appendix B.

Concurrent with the employee interviews, the applicable federal, state and local agencies were contacted for pertinent study area related environmental data. The agencies contacted are listed below and in Appendix B.

- o U.S. Geological Survey, Water Resources Division (Austin, TX)
- o Texas Department of Health (Abilene and Austin, TX)
- o Texas Department of Water Resources (San Angelo, TX)
- o Abilene Water and Sewer Utilities Department (Abilene, TX)
- o Office of Air Force History (Washington, DC)
- o Washington National Record Center (Suitland, MD)
- o National Archives (Washington, DC and Alexandria, VA)

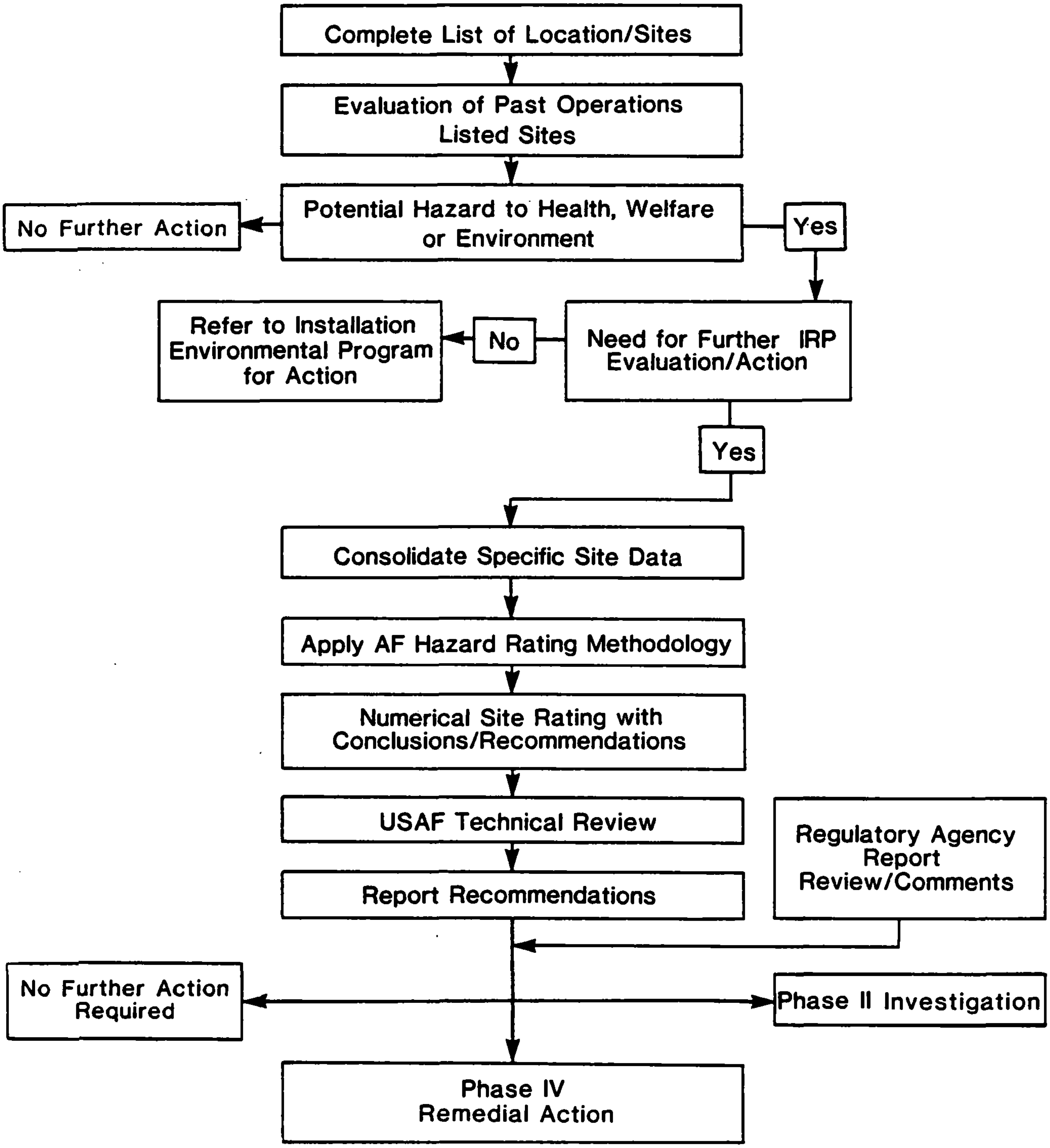
The next step in the activity review was to identify all sources of hazardous waste generation and to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the various sources on the base. Included in this part of the activities review was the identification of all known past disposal sites and other possible sources of contamination such as spill areas.

A general ground tour and an overflight of the identified sites were made by the ES Project Team to gather site-specific information including: (1) general observations of existing site conditions; (2) visual evidence of environmental stress; (3) presence of nearby drainage ditches or surface waters; and (4) visual inspection of these water bodies for any obvious signs of contamination or leachate migration.

A decision was then made, based on all of the above information, whether a potential hazard to health, welfare or the environment exists at any of the identified sites using the Flow Chart shown in Figure 1.2. If no potential existed, the site received no further action. For those sites where a potential hazard was identified, a determination of the need for IRP evaluation/action was made by considering site-specific conditions. If no further IRP evaluation was determined necessary, then the site was referred to the installation environmental program for appropriate action. If a site warranted further investigation, it was evaluated and rated using the Hazard Assessment Rating Methodology (HARM). The HARM score is a resource management tool which indicates the relative potential for adverse effects on health or the environment at each site evaluated.

PHASE I INSTALLATION RESTORATION PROGRAM

RECORDS SEARCH FLOW CHART



Source: AFESC

SECTION 2

INSTALLATION DESCRIPTION

LOCATION, SIZE AND BOUNDARIES

Dyess AFB is located in the City of Abilene and Taylor County, Texas. As shown in Figure 2.1, the base is approximately 150 miles west of the Dallas-Ft. Worth metropolitan area. The base is situated on the southwest edge of the city near U.S. Highways 80 and 84 (Figure 2.2).

The base includes 5,216 acres of Air Force owned land (Figure 2.3). The northern and eastern areas of the base are primarily bordered with residential development while the southern and western areas are adjoined with agricultural land. The base has six Air Force owned annexes which are located nearby:

- Receiver Annex - This 40-acre communication site is located approximately 1/2 mile west of the base.
- Transmitter Annex - This communication annex is about 1/4 mile west of the north runway clear zone and comprises 20 acres.
- Middle Marker (ILS) Annexes - Two middle marker navigational aid annexes exist, one at the north and one at the south end of the runway. The sites are a few hundred feet from the installation boundary and have a total area of approximately 0.2 acres.
- Ceilometer Annexes - Two ceilometer navigational aid annexes are located at each end of the runway. The sites are approximately 1/4 mile from the base and consist of about 1/2 acre of land.

HISTORY

The history of Dyess AFB is linked back to World War II. In the period 1942-1946 the Tye Army Airfield was operated at the present site as an extension of the mission of Camp Barkeley located several miles south of Abilene. Pilot training existed at the site on runways located

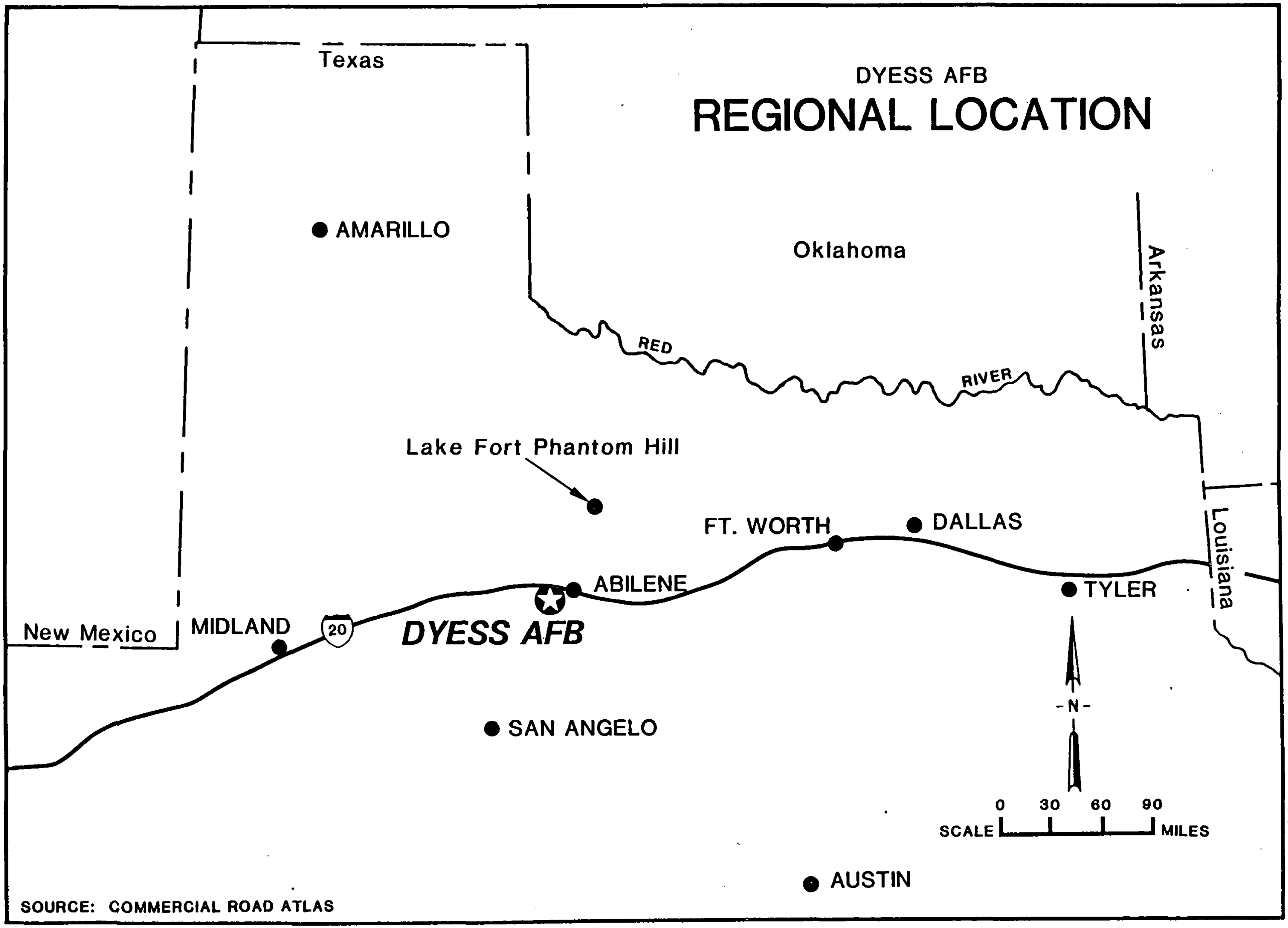
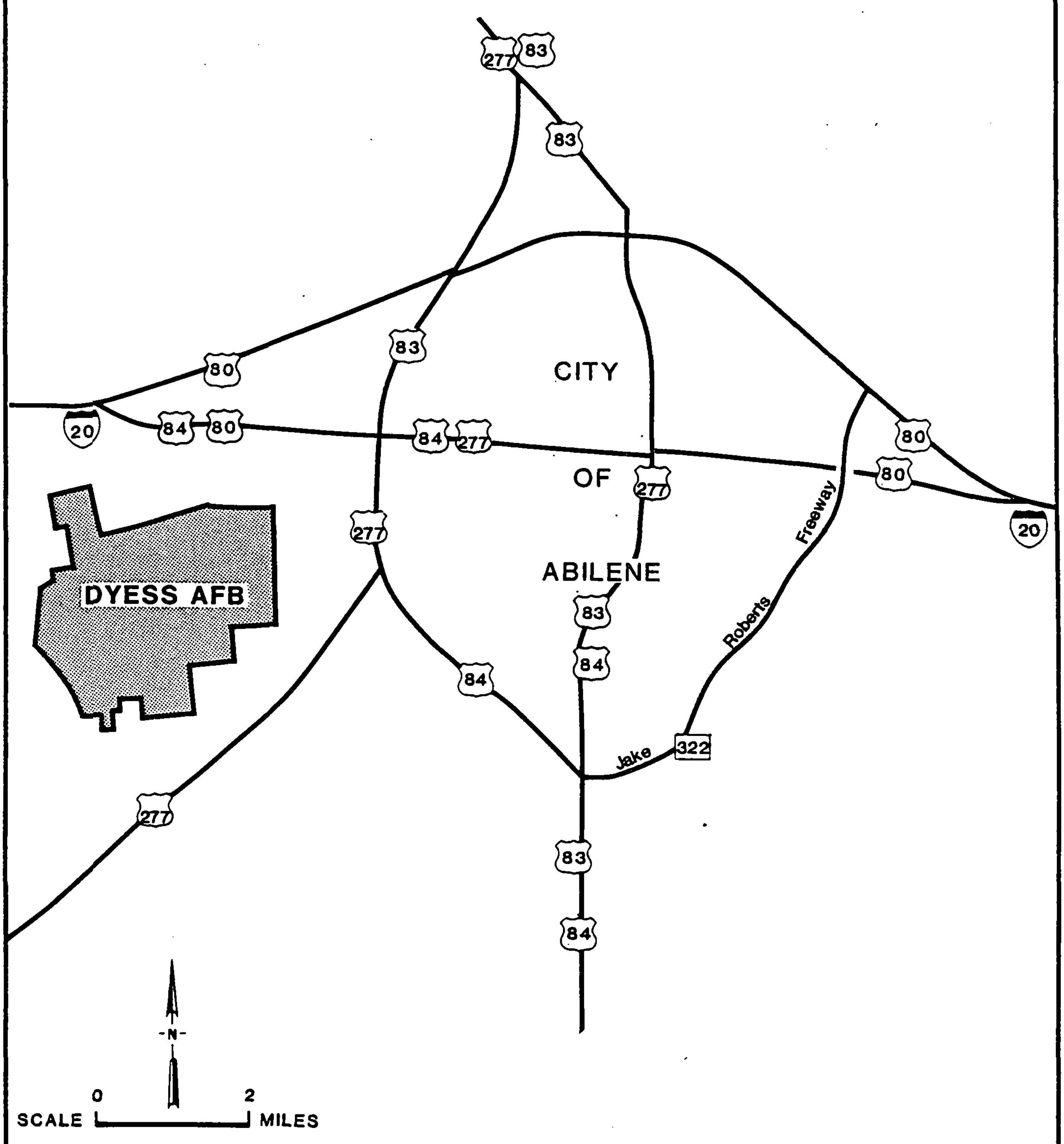


FIGURE 2.1

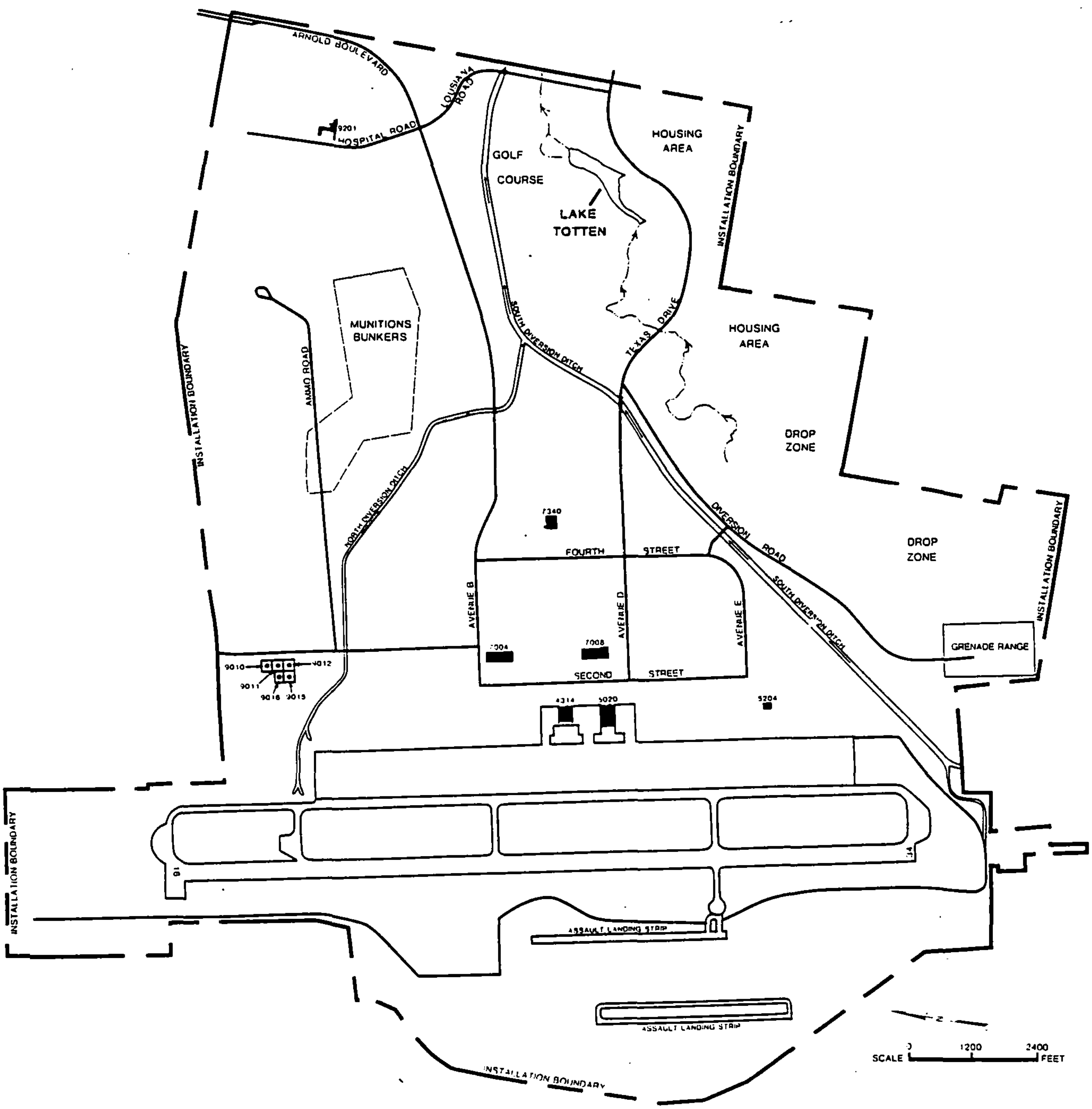
ES ENGINEERING-SCIENCE

DYESS AFB
AREA LOCATION



SOURCE: COMMERCIAL ROAD MAP

DYESS AFB
INSTALLATION SITE PLAN



SOURCE: INSTALLATION DOCUMENTS

west of the existing base runway. A few wooden structures were constructed but the installation was never intended as a permanent facility. The land was turned over to the city at the end of the war and it then was used for training by the National Guard.

Dyess was approved for construction as a Strategic Air Command (SAC) base in 1952 and the first unit was activated in 1955. The first aircraft arriving on base in 1956 were the B-47 bomber and KC-97 tanker.

From 1961 to the present, troop carrier activities have also taken place at Dyess AFB, first under the Tactical Air Command (TAC) and later under the Military Airlift Command (MAC).

Between 1961 and 1965 Dyess AFB contained maintenance facilities for numerous missile launch silos located around the installation.

Numerous large multi-engined aircraft have been stationed at the base since it started in 1955-1956. The aircraft currently assigned include KC-135 tankers and C-130 troop/cargo carriers. The B-52 aircraft were phased out in 1984-1985 in anticipation of the B-1 bomber which arrives this year.

ORGANIZATION AND MISSION

The 96th Bombardment Wing (SAC) is the host unit at Dyess AFB. Major units within the wing include Maintenance, Operations, Resource Management, Combat Support and USAF Hospital Dyess. The 12th Air Division Headquarters is also located at Dyess AFB.

The primary mission of the 96th Bombardment Wing is to develop and maintain operational capability to permit the conduct of strategic warfare. Operations directs the flight crews and equipment and Maintenance manages the aircraft maintenance resources. Resource Management provides supply, transportation and other logistical support. The 96th Combat Support Group manages and maintains all base facilities and service functions. Medical services are provided by the USAF Hospital.

The largest tenant at Dyess is the MAC 463rd Tactical Airlift Wing. The mission of the MAC Wing is to provide assigned airlift operations for personnel, equipment and supplies. Major units within this Wing are

Air Transportation, Maintenance, Operations and Resource Management. Air Transportation coordinates 1st Mobile Aerial Port Squadron (MAPS) activities and the other units have functions comparable to their 96th Bombardment Wing counterparts.

Other tenant organizations are listed in Appendix C along with the missions of the major units.

SECTION 3

ENVIRONMENTAL SETTING

The environmental setting of Dyess AFB is described in this section with the primary emphasis directed toward the identification of features or conditions that may facilitate the generation and migration of hazardous waste-related contamination. Environmentally sensitive conditions pertinent to this study are summarized at the end of the section.

CLIMATE

Temperature, precipitation, snowfall and other relevant climatic data furnished by Detachment 16, 9th Weather Squadron, Dyess AFB, Texas are listed in Table 3.1. The period of record is twenty-one years. The summarized data indicate mean annual precipitation is 25.3 inches. The net annual precipitation is calculated to be minus 43 inches, based on National Oceanographic and Atmospheric Administration (NOAA) information (NOAA, 1983). The net annual precipitation is an estimate of the amount of rainfall/snowfall potentially available for infiltration into the subsurface and does not consider evapotranspiration, which varies seasonally. Net precipitation is equal to total precipitation minus evaporation. Since the net annual precipitation is negative, the infiltration potential for Dyess AFB is considered to be minimal. The one-year, twenty-four hour rainfall value for the study area is 2.6 inches, which has been interpolated from charts published by the U.S. Department of Commerce, Weather Bureau (1961). This figure suggests that a moderate potential for the development of erosion exists, irrespective of slope and soil conditions.

The study area is located along the boundary delineating the subhumid climate of east Texas and the semi-arid conditions prevalent in west and north Texas. The summers tend to be warm and dry; winters tend to be relatively mild. The warmest months are May to September; the coldest include December to February. Precipitation occurs mainly

TABLE 3.1
CLIMATOLOGICAL DATA

MONTH	Temperature (°F) Mean Daily Max	Temperature (°F) Mean Daily Min	Temperature (°F) Mean Monthly	Temperature (°F) Extreme Max	Temperature (°F) Extreme Min	Precipitation (In) Monthly Mean	Precipitation (In) Monthly Max	Precipitation (In) Monthly Min	Precipitation (In) Max 24 Hrs	Snowfall (In) Monthly Mean	Snowfall (In) Monthly Max	Surface Winds Prevailing Direction	Surface Winds Mean Speed (kt)
JAN	55	31	43	89	-7	1.2	5.3	-	2.0	2	18	N	7
FEB	60	36	48	89	7	1.1	3.5	-	1.5	1	7	S	8
MAR	67	43	55	96	9	1.1	2.7	.1	2.3	1	7	S	9
APR	76	53	65	99	27	2.8	10.2	-	5.9	0	0	S	9
MAY	83	61	72	108	35	3.3	14.7	.2	4.6	0	0	S	8
JUN	90	69	80	107	50	2.4	7.4	.7	2.9	0	0	S	8
JUL	94	73	83	106	57	2.4	8.6	-	5.5	0	0	S	7
AUG	93	71	82	108	53	2.6	8.9	-	2.5	0	0	S	6
SEP	85	65	75	105	39	3.7	10.9	-	3.4	0	0	S	6
OCT	76	54	65	98	29	2.5	5.7	.2	4.8	0	0	S	6
NOV	65	43	54	87	16	1.4	4.4	-	2.7	1	8	S	7
DEC	58	35	47	86	9	.8	3.3	-	1.1	0	4	S	7
ANNUAL	75	53	64	-	-	25.3	-	-	-	5	-	S	7

Source: Detachment 16, 9th Weather Squadron, Dyess AFB, Texas

Period of Record: 1956 - 1977

during the spring, summer and autumn months of April through October. Surface wind directions favor the south during most of the year.

GEOGRAPHY

The study area lies with the Osage Plains subdivision of the Central Lowland Physiographic Province. The Osage Plains is an eastward sloping upland plain that adjoins the High Plains to the west and the Great Plains to the east and south (Rawson, 1967). The general area is characterized by nearly level to gently rolling hills and broad flat plains. Major streams are well entrenched. The valleys of secondary streams may exhibit a sag and swale appearance, indicative of the erosion of somewhat cohesive native soils. Study area physiographic divisions are illustrated in Figure 3.1.

Topography

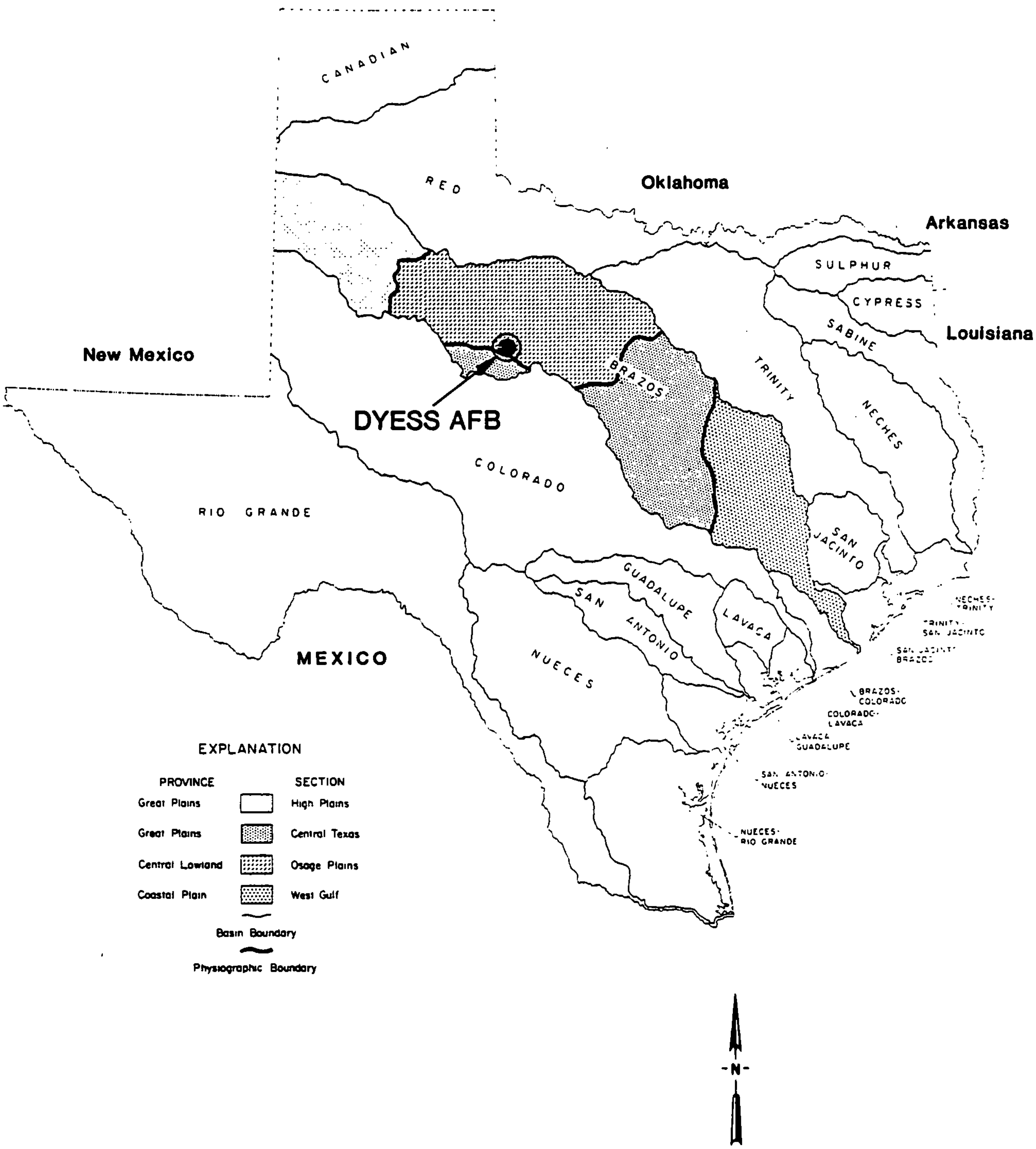
The topography of Abilene and the surrounding area varies from generally level to gently rolling in appearance. Local relief is primarily the result of dissection by erosional activity, stream channel development or site use modifications. At Abilene, ground surface elevations average 1,718 feet, National Geodetic Vertical Datum of 1929 (NGVD). At Dyess AFB, surface elevations vary from 1,733 feet, NGVD near the entrance to the base at the Main Gate to 1,820 feet, NGVD in the area north of Taxiway No. 1. Installation relief is seldom more than ten feet and is most conspicuous along the alignment of Little Elm Creek.

Drainage

The drainage of Dyess AFB land areas is accomplished by overland flow of runoff to diversion structures and then to area surface streams, which flow intermittently. The southeast section of the base drains to Tributary 1 of Little Elm Creek and the South Diversion Ditch. The north and east sections of the installation drain to Tributary 2 (North Diversion Ditch) of Little Elm Creek and the main stem of Little Elm Creek which flows through the base golf course. The south and extreme northeast segments of the base drain directly to Little Elm Creek. Little Elm Creek drains to Elm Creek, which in turn, discharges into Lake Fort Phantom Hill. Lake Fort Phantom Hill (located ten miles northeast of Abilene in Jones County), is the principal source of potable water supplies for the City of Abilene.

DYESS AFB

STUDY AREA PHYSIOGRAPHIC DIVISIONS AND MAJOR RIVER DRAINAGE BASINS



SOURCE: MODIFIED FROM RAWSON, 1967

SCALE 0 100 200 MILES

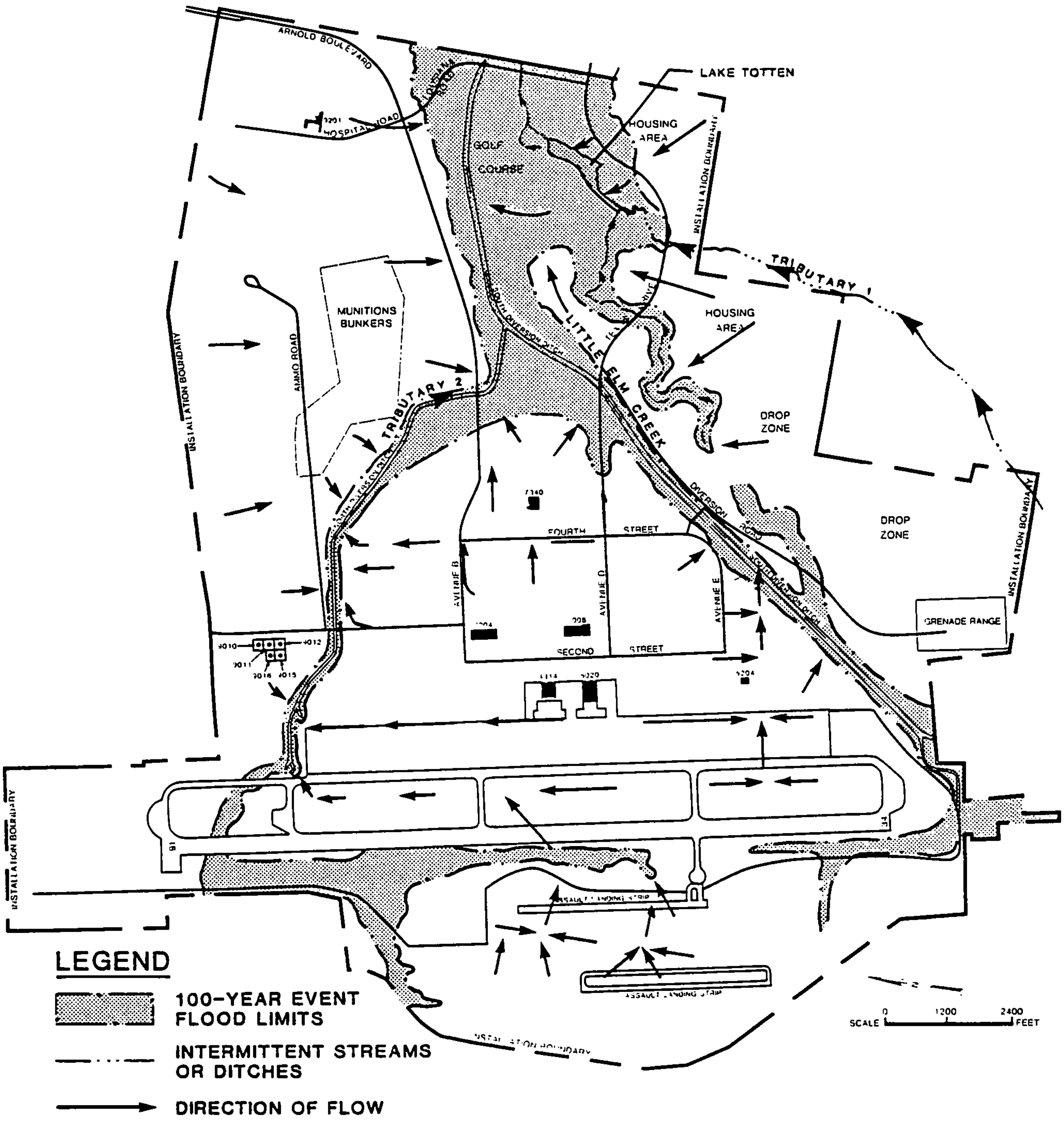
Wetland zones have been identified adjacent to the course of the North and South Diversion Ditches (Dyess AFB, undated). Flooding may occur at the base when rainfall is of sufficient intensity and duration. The level nature of the installation land surface and drainage structures such as culverts may restrict runoff until such time as temporarily impounded flood waters are permitted to dissipate. Localized flooding may effect parts of the base adjacent to Little Elm Creek and its tributaries including the housing area, roads and the installation water treatment plant. Dyess AFB drainage features are illustrated in Figure 3.2.

Surface Soils

The surface soils of Dyess AFB have been mapped by the USDA, Soil Conservation Service (1976). Twenty six soil types have been identified on the installation. Their principal characteristics relative to this study are summarized in Table 3.2. The distribution of the base soils is illustrated in Figure 3.3. The modern soils of Dyess AFB have developed primarily in calcareous clayey sediment or alluvium, deposited by flowing water. A few base soils units have formed in residuum (a soil formed by the weathering of bedrock which retains the relict structural appearance of the rock). The residual soils occur at the highest elevations on base. Soils that have formed in residuum are clayey and are usually less than thirty six inches thick. They are underlain by solid bedrock. The water deposited soils may have a profile thickness on the order of eight feet. According to installation test borings, they are locally underlain by a permeable sand and gravel, two to fifteen feet thick. Most of the soil units mapped in the upland areas of the base include clay, silt and loam, possess very low to low permeabilities and tend to promote rapid runoff. The soil units mapped in base drainageways are clayey silts, clayey sands and loamy soils that possess low to moderate permeabilities. The properties of two units identified on base, Urban Land (Ub) and "Refuse Area" have not been estimated. The surface soils present in these areas have been removed, buried or altered locally as a result of extensive site use modifications. The "Refuse Area" may have been a sand and gravel pit at the time the soil survey of Taylor County was performed, as sand and gravel is known to underlie Little Elm Creek alluvium at shallow depths. The same area was

DYESS AFB

DRAINAGE MAP



SOURCE: INSTALLATION DOCUMENTS

TABLE 3.2
DYESS AIR FORCE BASE SOILS

Map Symbol (Figure 3.3)	Unit Description (Major Fraction)	USDA Texture (Major Fraction)	Thickness (Inches)	Unified Classification (Major Fraction)	Permeability (Inches/Hours)	Parent Material	Potential Site Disposal Contraints**
Cr	Colorado Soils	Loam, clay loam	60	ML, CL	0.6-2.0	S	Severe. Frequent flooding
Ga	Gageby clay loam	Clay loam, sandy clay loam	80	CL	0.6-2.0	S	Severe. Intermittent flooding.
HbA	Hamby loam, 0-1% slopes	Sandy loam, loamy sand, clay	83	SM, SC, CL	0.2-6.0	S	None.
HbB	Hamby loam, 1-3% slopes	Silt loam, silty clay, clay	81	CL, CH	0.2-0.6	S	None.
HuB	*Hamby-Urban Land Complex	Sandy loam, clay, clay loam	83	SM, SC, CL	0.2-6.0	S	None.
Ma	Mangum silty clay loam	Silty loam, silty clay, clay	81	CH, CL	0.2-0.6	A	Severe. Intermittent flooding.
Obe	Owens-Badland Complex 3-12% slopes	Clay, shaly clay	24	CH, CL	<0.06	R	Severe. Bedrock <24"
Ra	Randall clay	Clay	90	CH, CL	<0.06	S	Severe. Intermittent flooding.
RnA	Rotan clay loam	Clay loam, clay	80	CH, CL	0.2-2.0	S	None.
RoA	Rowena clay loam, 0-1% slopes	Clay loam, clay	64	CH, CL	0.2-0.6	S	None.
RoB	Rowena clay loam, 1-3% slopes	Clay loam, clay	64	CH, CL	0.2-0.6	S	None.
RuA	*Rowena-Urban Land Complex	Clay loam, clay	64	CH, CL	0.2-0.6	S	None.
SaA	Sagerton clay loam, 0-1% slopes	Clay loam, clay	80	CL	0.2-0.6	S	None.
SaB	Sagerton clay loam, 1-3% slopes	Clay loam, clay	80	CL	0.2-0.6	S	None.
SeB	*Sagerton-Urban Land Complex	Clay loam, clay	80	CL	0.2-0.6	S	None.
StB	Stamford clay	Clay, silty clay, clayey shale	100	CH, CL	<0.06	S	None.

TABLE 3.2
(Continued)
DYESS AIR FORCE BASE SOILS

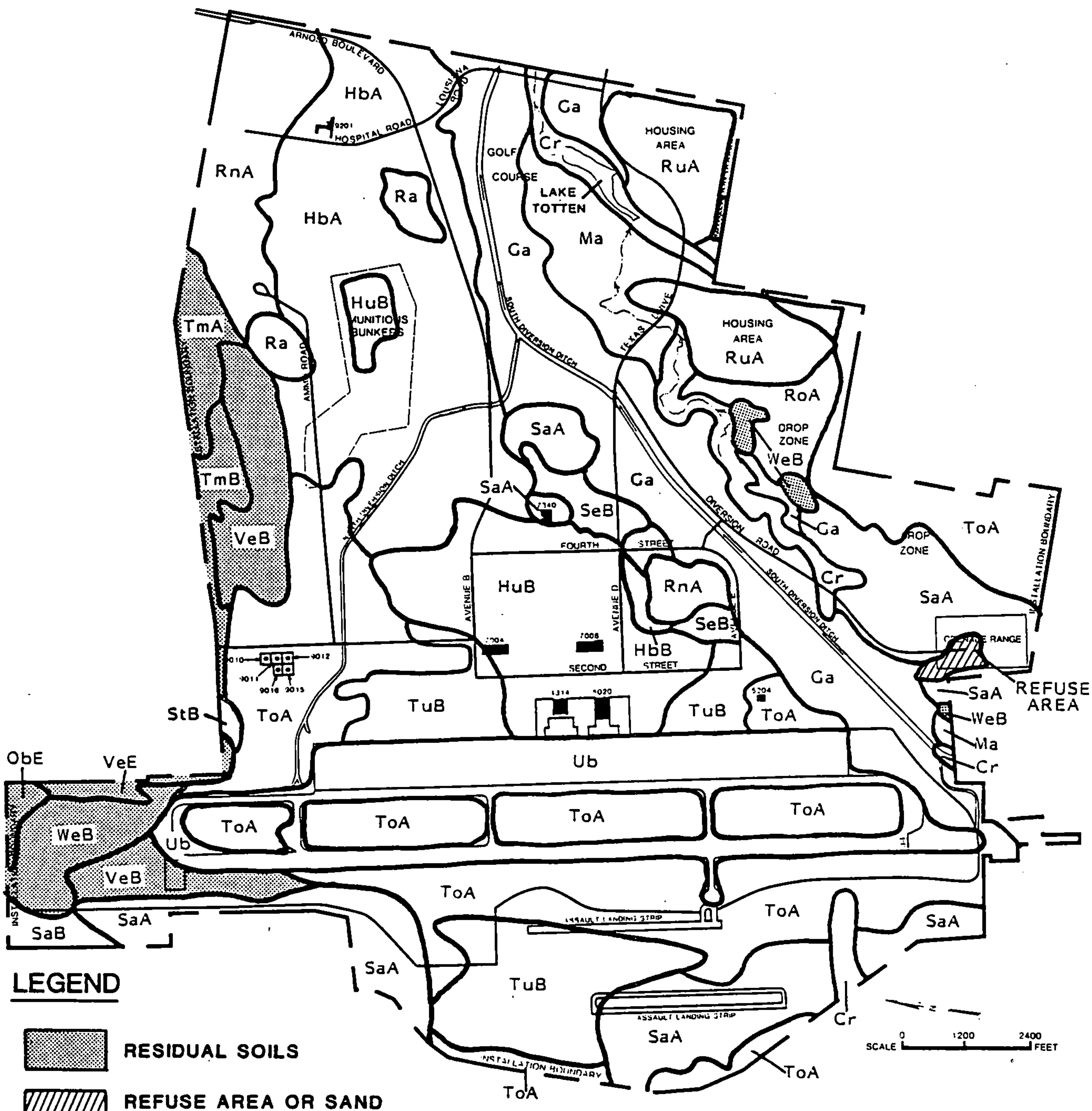
Map Symbol (Figure 3.3)	Unit Description (Major Fraction)	USDA Texture (Major Fraction)	Thickness (Inches)	Unified Classification (Major Fraction)	Permeability (Inches/Hours)	Parent Material	Potential Site Disposal Contraints**
TmA	Tillman clay loam, 0-1% slopes	Clay loam, clay, silty clay	72	CH, CL	0.06-0.6	R	None.
TmB	Tillman clay loam, 1-3% slopes	Clay loam, clay, silty clay	72	CH, CL	0.06-0.6	R	None.
ToA	Tobosa clay	Clay, silty clay	72	CH, CL	<0.06	S	None.
ToB	Tobosa clay	Clay, silty clay	72	CH, CL	<0.06	S	None.
TuB	*Tobosa-Urban Land Complex	Clay, silty clay	72	CH, CL	<0.06	S	None.
Ub	Urban land	---	TOO VARIABLE TO BE ESTIMATED		--	-	--
VeB	Vernon clay, 1-3% slopes	Clay, silty clay, shale	60	CH, CL	0.06-0.6	R	Severe. Bedrock <36"
VeE	Vernon clay, 3-12% slopes	Clay, silty clay, shale	60	CH, CL	0.06-0.6	R	Severe. Bedrock <36"
WeB	Weymouth clay loam	Clay loam, clayey shale	42	CL	0.6-2.0	R	None.
Refuse Area	---	---	TOO VARIABLE TO BE ESTIMATED		--	-	--

Source: Modified from USDA, SCS, 1976

Notes:
* Urban land portion of the unit may be highly variable
  Unified System Classifications: ML = Low Plasticity Silt; SM = Silty Sand; SC = Clayey Sand; CL = Low Plasticity Clay; CH = High Plasticity Clay.
  Parent Material: S = Sediment; A = Alluvium; R = Residuum

** These constraints are cited in the SCS reference. The noted constraints are generalized and require site-specific investigations to verify the soil conditions.

DYESS AFB
SOILS MAP



LEGEND

- RESIDUAL SOILS
- REFUSE AREA OR SAND AND GRAVEL PIT
- ALLUVIAL AND/OR CLAYEY SEDIMENTS

SOURCE: MODIFIED FROM USDA, SCS, 1976

indicated to be "gravel pits" on the Abilene West 7.5 -Minute Topographic Map. The topographic map depicted base conditions as of 1974. The aerial imagery used by the Soil Conservation Service as a base map on which to plot the distribution of county soil units was dated 1972.

GEOLOGY

Information describing the geology of the Dyess AFB study are has been reported by Sellards, et al., 1932 (reprinted 1981); Cronin, et al., 1963; Texas Bureau of Economic Geology, 1972; Kier, et al., 1977 and Taylor, 1978. Additional information has been obtained from an interview with a U.S. Geological Survey scientist. A brief overview of the available information with pertinent comments is included in the following discussion.

Regional Geology

Geologic units ranging in age from Permian to Quaternary have been identified as significant to subsurface investigations in the project area. These units consist of unconsolidated alluvium and residual soils composed of sand, gravel, silt, clay, caliche, petrified wood and bone fragments and consolidated rock (Cretaceous and older) limestone, mudstone, chert, sandstone, conglomerate, shale, dolomite, anhydrite, siltstone and gypsum. Table 3.3 summarizes the major geologic units of the study area and describes their significant characteristics, in chronological order.

Stratigraphy and Distribution

The surface distribution of major geologic units mapped at Dyess AFB is shown in Figure 3.4, which is modified from the Geologic Atlas of Texas, Abilene Sheet (TBEG, 1972) and from Taylor (1978). Generally, the geology at the base is dominated by two principal units: the Upper Permian Vale Formation of the Clear Fork Group and Quaternary Alluvium.

The Vale Formation occurs as a broad band extending through the center of Taylor County. It is present within a few feet of ground surface (usually less than twenty) and consists of relatively flat-lying red shales with thin scattered lenticular red and gray sandstones in lower sections and numerous thin interbedded dolomite and shales stringers in the upper part. It is reported that the Bullwagon Dolomite Member occurs near the top of the Vale Formation (Taylor, 1978). The

TABLE 3.3

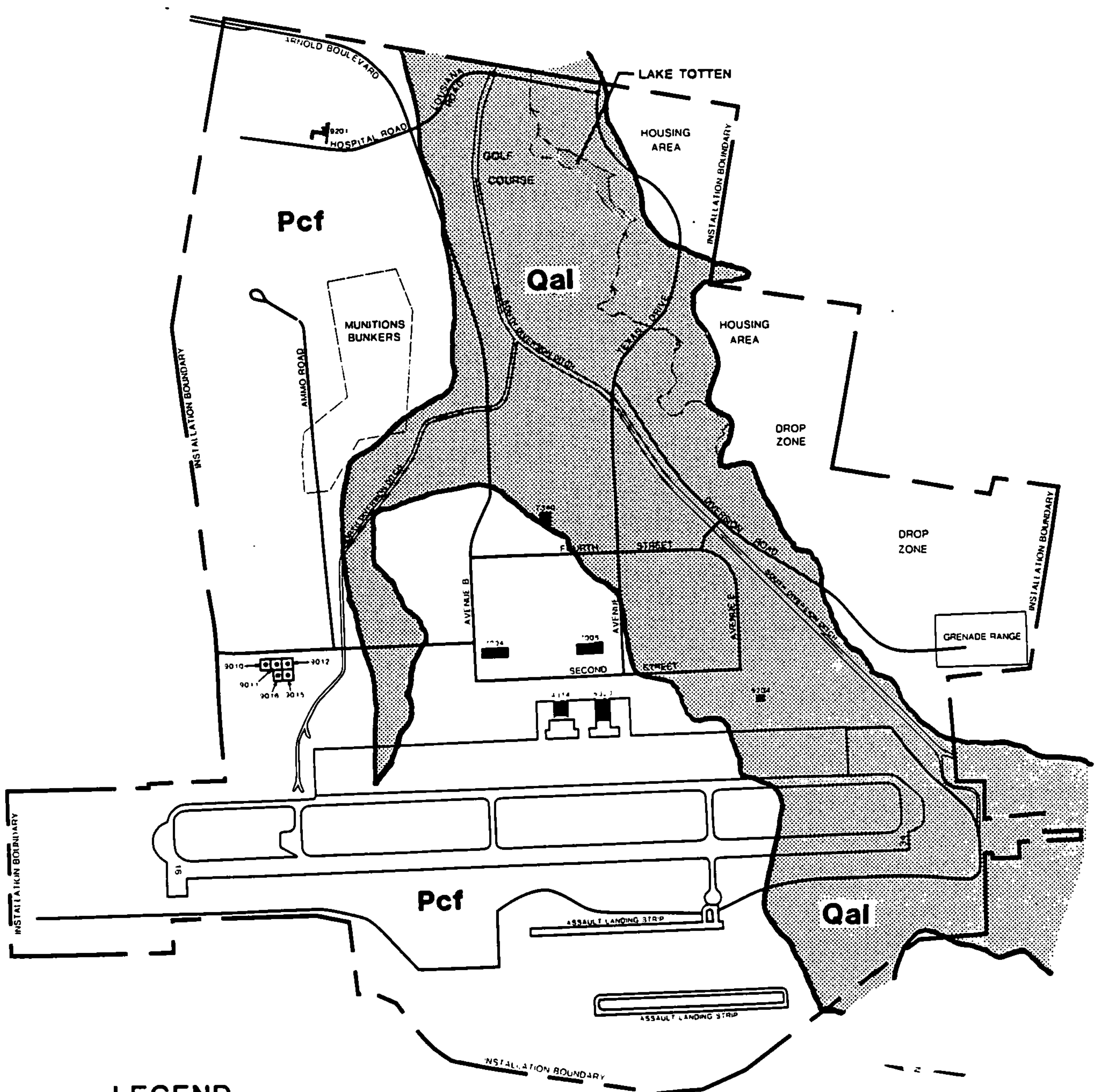
Taylor County Geologic Units and Water-Bearing Properties

SYSTEM	SERIES	GROUP	FORMATION	MEMBER	APPROXIMATE MAXIMUM THICKNESS (ft)	LITHOLOGIC CHARACTER	WATER-BEARING CHARACTERISTICS
Quaternary	Recent	Unconformity	Alluvium		30	Cross-bedded sandstones, gravel, fine silts, and sandy clays occurring in and bordering most of the stream channels in the county.	Yields fresh to moderately saline water in small to moderate quantities to wells mostly in the eastern two-thirds of the county.
Quaternary	Pleistocene		Undivided surficial deposits		10	Residual soils of caliche and lag gravels capping many of the low-lying hills in the northern half of the county.	Known to yield small quantities of fresh to slightly saline water to one well and one spring in the northern half of the county.
Quaternary	Pleistocene		Seymour		40	Contains fine grained, white, light tan to red sands and silts; reddish-orange and gray clay; and white to buff nodules of caliche (usually near surface). Lower portion of the formation is coarse gravels or conglomerates containing well rounded pebbles of quartz, quartzite, igneous crystalline rocks, bone fragments, petrified wood, scattered water-worn Cretaceous fossils, and cobbles and pebbles of limestone.	Known to yield small quantities of water to three wells along the county line north of Merkel in the northwest part of the county. Water in one well was fresh.
Cretaceous	Comanche	Fredericksburg	Edwards Limestone		100	Gray to near-white, dense to fine crystalline, thin to thick-bedded limestone with thin irregular layers and nodules of dark bluish-gray chert.	Yields fresh water in small quantities to scattered wells and springs in the southern part of the county.
Cretaceous	Comanche	Fredericksburg	Comanche Peak Limestone			Gray, thin to irregular, wavy-bedded, fossiliferous limestone with thin interbedded clay.	
Cretaceous	Comanche	Fredericksburg	Walnut			Marly, laminated, light gray to yellowish clay; some thin semi-crystalline limestone lenses locally.	
Cretaceous	Comanche	Trinity	Antlers		200	Lower and upper parts chiefly sand, middle part mainly clay. Sand is cream to near white, fine to medium grained, moderately to well sorted, weathers buff to locally varigated, some cross-bedding, argillaceous in the upper part, locally conglomeratic in the lower part. Middle part chiefly red to pink, purple, locally gray and green clay, silty, with occasional beds of hard calcareous siltstone. Conglomerate in lower part made up of chert and quartzite pebbles.	Yields fresh water in small quantities to wells and springs in the southern part of the county.
Permian	Leonard	Pease River	San Angelo		200	Cross-bedded sandstone, greenish-gray, usually well consolidated, medium-grained, sub-angular to well-rounded near top of unit; lower portion is clay balls, sandstone as above interbedded with cherty conglomerates, gypsum nodules, streaks of "satin spar" gypsum, and red and green shales. Weathers dark red.	Yields fresh to moderately saline water in small to moderate quantities to wells along the extreme western edges of the county.
Permian	Leonard	Clear Fork	Choza	Merkel Dolomite	5 510	The gray Merkel dolomite, at or near the top of this formation, is not believed to be present southward from a point just south of Interstate 20 and about 1.5 miles east of Trent. The remainder of the formation consists of semi-persistent beds of gray dolomite and anhydrite interspersed in red shales and, locally, thin poorly developed sandstone lenses.	Yields fresh to moderately saline water in small to moderate quantities to wells in the western part of the county.
Permian	Leonard	Clear Fork	Vale	Bullwagon Dolomite	10 560	Upper portion of the formation is comprised of many thin beds of gray dolomite and anhydrite interbedded with some clay, but mainly red shales. Lower portion of unit is dominately red shale with thin stringers of dolomite and a few thin lenticular shaley sandstones. This lower red shale unit thins to the west.	Yields fresh to moderately saline water in small quantities to a few wells in the eastern half of the county.
Permian	Leonard	Clear Fork	Arroyo	Standpipe Limestone Kirby Lake Limestone Lytle Limestone Rainy Limestone	250	White, cream-colored, buff and brown, thin bedded and poorly developed limestones, dolomites, and marls interbedded with thick gray and red shales and lenticular shaley sandstones. Anhydrite is present, locally, near the base of the formation in the Lytle and Rainy Limestone Members.	Yields fresh to slightly saline water in small quantities to a few scattered wells in the eastern part of the county.
Permian	Leonard	Wichita	Lueders		80	Thin bedded, gray to buff, fossiliferous limestone interbedded with argillaceous limestone and gray to greenish gray shales. Unit grades into dolomite westward in the subsurface.	Yields slightly to moderately saline water in small quantities to a few scattered wells in the eastern part of the county.

Yield of Wells: Small, less than 100 gpm (gallons per minute); moderate, 100–1,000 gpm; large, more than 1,000 gpm.

Source Modified from Taylor 1978

DYESS AFB
GEOLOGIC MAP



LEGEND

Pcf PERMIAN CLEAR FORK GROUP (vale formation)

Qal QUATERNARY ALLUVIUM

SOURCE: MODIFIED FROM TEXAS BUREAU OF ECONOMIC GEOLOGY, 1972

Vale Formation's occurrence in the study area corresponds with the mapping unit identified by Kier, et al. (1977) as "undissected red beds" in a publication describing the land resources of Texas. The unit was noted for its lack of major geologic features, a low to moderate infiltration capacity and a poor potential for development as an aquifer.

The Vale Formation is overlain by a thin soil overburden, ranging in thickness from two to twenty feet at Dyess AFB. The bedrock appears to be closest to ground surface in topographically high areas of the base. On these localized uplands, the Vale red beds appear to be overlain by two to three foot accumulations of residual soils (refer to map units ObE, TmA, TmB, VeB, VeE and WeB in Table 3.2 and Figure 3.3). The residual soils are principally clays that have developed as a result of the in-situ weathering of the parent shale bedrock. The bedrock present beneath sloping areas and base lowlands is mantled by a five to twenty-foot section of calcareous clayey sediment. According to installation test boring data, the sediment consists of clays and silts in its upper section and includes distinct sand and gravel layers at its lower extent, just above the red shales of the Vale Formation (local bedrock). The sediment was deposited as a result of the action of running water flowing northward along historic drainage paths. The sediment occupies a much larger share of base land area than the residual soils, whose distrubution is restricted to the highest elevations.

The second major geologic unit shown in Figure 3.4 is the Quaternary Alluvium (map symbol: Qal). At Dyess AFB, the distribution of the alluvium is restricted to the modern and historic channels and floodplains of Little Elm Creek and its tributaries. The alluvium occurs at ground surface within installation boundaries. Alluvial deposits consist of sand, silt, clay and gravel in a mixed to stratified sequence normally less than thirty feet thick. The finer materials (fine sand, silt and clay) appear to be present in greater abundance near the top of the unit. The coarser materials (medium to coarse sand and gravel) occur in the lower extent of the unit, just above bedrock. The alluvium's occurrence in the study area corresponds with the mapping unit identified by Kier, et al. (1977) as "flood-prone areas". The materials reported to be present within this unit include sand, gravel, mud, etc., similar to that described above. The flood-prone areas are reported to be significant due to their development potential for sand and gravel resources (implying that large quantities of sand and gravel are available within the unit's limits) and for a minor source of water supply.

Structure

The major structural geologic features of the study area include the dip of the Permian strata and the apparent absence of faulting. The regional dip of the Permian units is reported to be about forty feet per mile. They crop out in irregular belts with a north-south trend and are successively younger from east to west across Taylor County (Taylor, 1978). Study area bedrock units do not appear to be disrupted by faults or other geologic discontinuities. The Quaternary deposits lie unconformably on Permian rocks and generally mirror local topography.

Figure 3.5 is a geologic cross-section drawn through Taylor County. It illustrates the major stratigraphic and structural relationships of the units present in the study area. The location and orientation of the geologic cross-section is shown in Figure 3.6.

HYDROLOGY

Study area hydrologic information has been reported by Smith (1940); Cronin, et al. (1963); Rawson (1967) and Taylor (1978). Additional information has been obtained from an interview with a U.S. Geological Survey scientist.

Ground-Water Resources

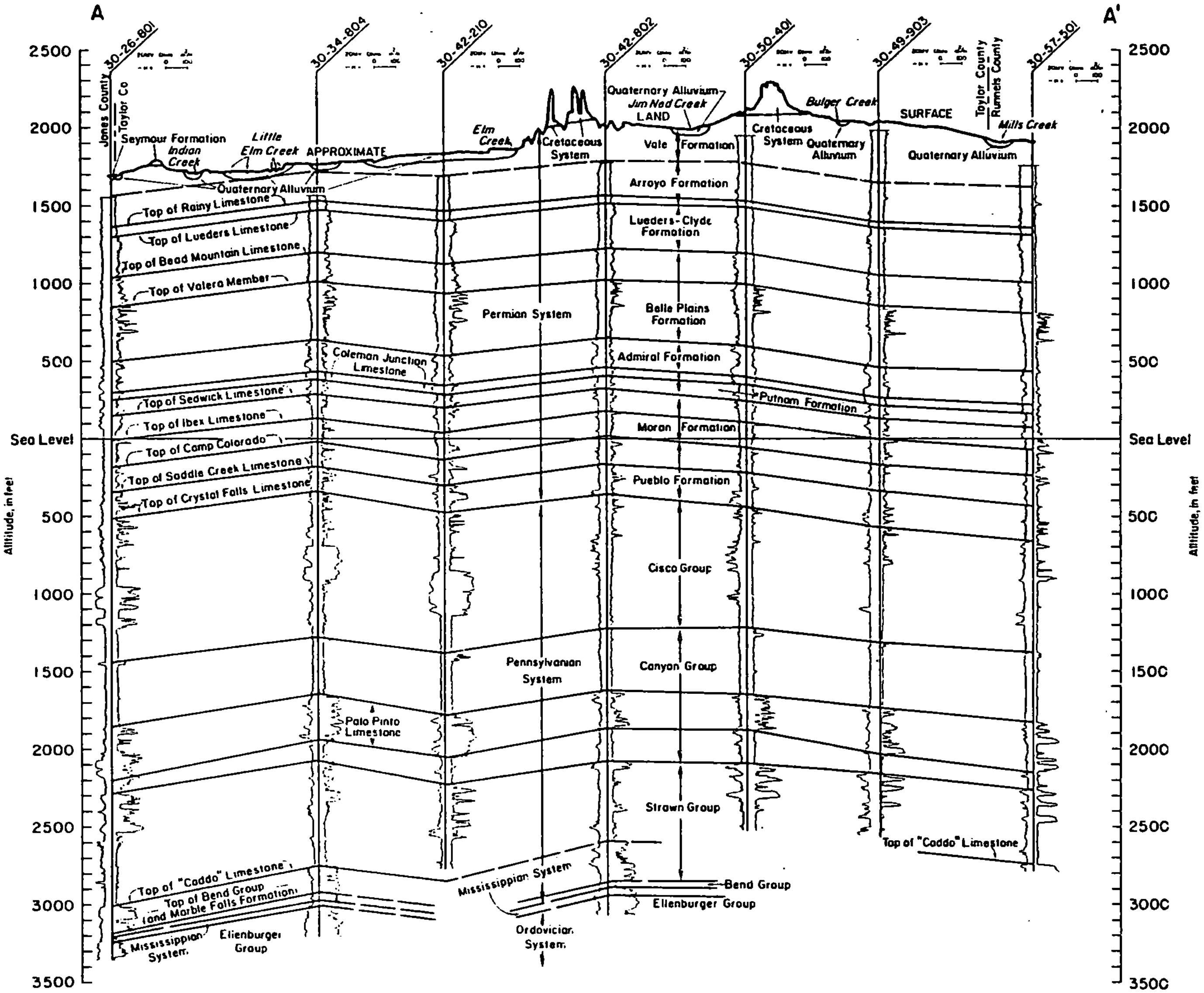
Dyess AFB is located in a section of Texas where no aquifers of regional significance exist. Two water-bearing units of minor importance are present in the study area and are identified as follows:

- Shallow Aquifer
- Deep Aquifer

Precipitation is the primary source of ground water in the project area. Although a portion of rainfall is lost as runoff directed to local surface waters or as evapotranspiration, a small amount is able to infiltrate downward until it reaches a level in the unconsolidated deposits where all available voids between soil particles are water-filled. Water contained in these void spaces is called ground water and

DYESS AFB

STUDY AREA GEOLOGIC CROSS-SECTION



SCALE 0 — 6 MILES

SOURCE: TAYLOR, 1978.

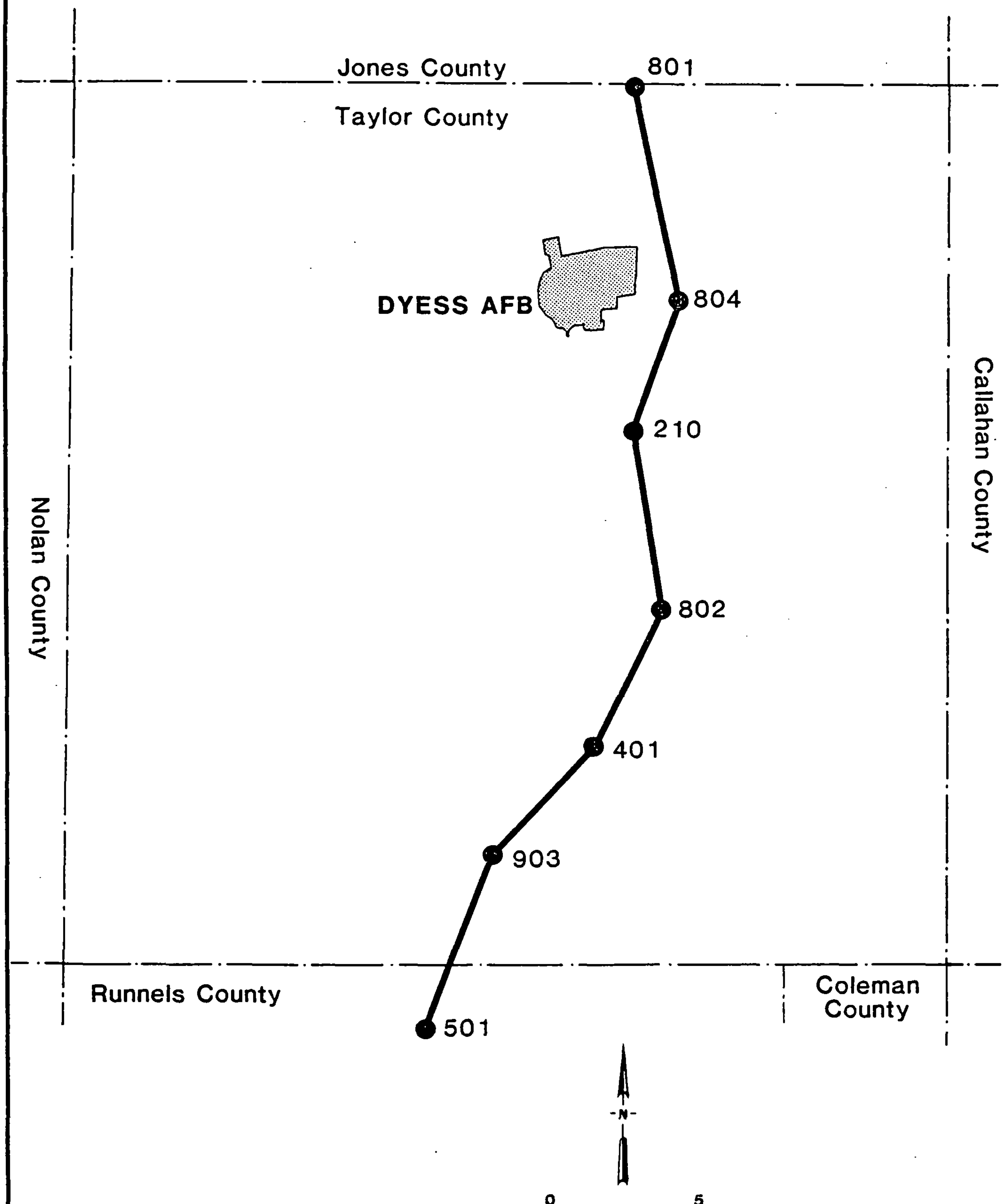
FIGURE 3.5

3-15

ES ENGINEERING-SCIENCE

DYESS AFB

CROSS-SECTION LOCATION MAP



SOURCE: MODIFIED FROM TAYLOR, 1978

is constantly in motion. Ground water tends to move from points where it enters the subsurface (recharge areas), where water levels are highest, to discharge areas, where water levels are lowest. A review of available data, topographic and surface water information and site inspections suggest that Dyess AFB is located in the recharge zone of the uppermost aquifers present. Ground water moving from the shallow aquifer recharge zone may flow into hydraulically communicating hydrogeologic units, thus recharging them, or may be directed to local surface waters as base flow (that portion of stream flow contributed by ground water). The actual flow directions, flow velocities, etc., for each water-bearing unit present on base must be treated as an individual case. The following discussion describes the significant properties of the waterbearing units considered to be relevant to this investigation.

Shallow Aquifer

The shallow aquifer present on base is probably the most important unit relevant to a waste-migration study, however, it is not completely defined in the study area. The literature currently available (Cronin, et al., 1963; Taylor, 1978 and others) suggests that the principal near-surface source of ground-water supplies is the Quaternary Alluvium, whose distribution is shown in Figure 3.4. It has been reported that ground water is present in sand and gravel zones occurring in the lower extent of the alluvium. Some wells have been installed into the alluvium to derive water supplies from it at locations near the base. However, installation test boring records suggest that a shallow aquifer existing on base may not be limited to the alluvium. Several test borings for base construction projects encountered a sand and gravel zone beneath the calcareous clayey sediments that form the overburden of the Vale Formation (bedrock). The gravel zone encountered at the hospital construction site occurred at a depth of some sixteen feet below land surface and contained ground water in a saturated thickness some seven feet thick. The water depth below land ranged from sixteen to twenty feet. The following is a summarized boring log from installation test boring number 8A-GC-239, located at the hospital:

0 - 11.4 feet:	sandy clay and clayey gravel
11.4 - 16.4 feet:	sand

16.4 - 23.5 feet: gravel

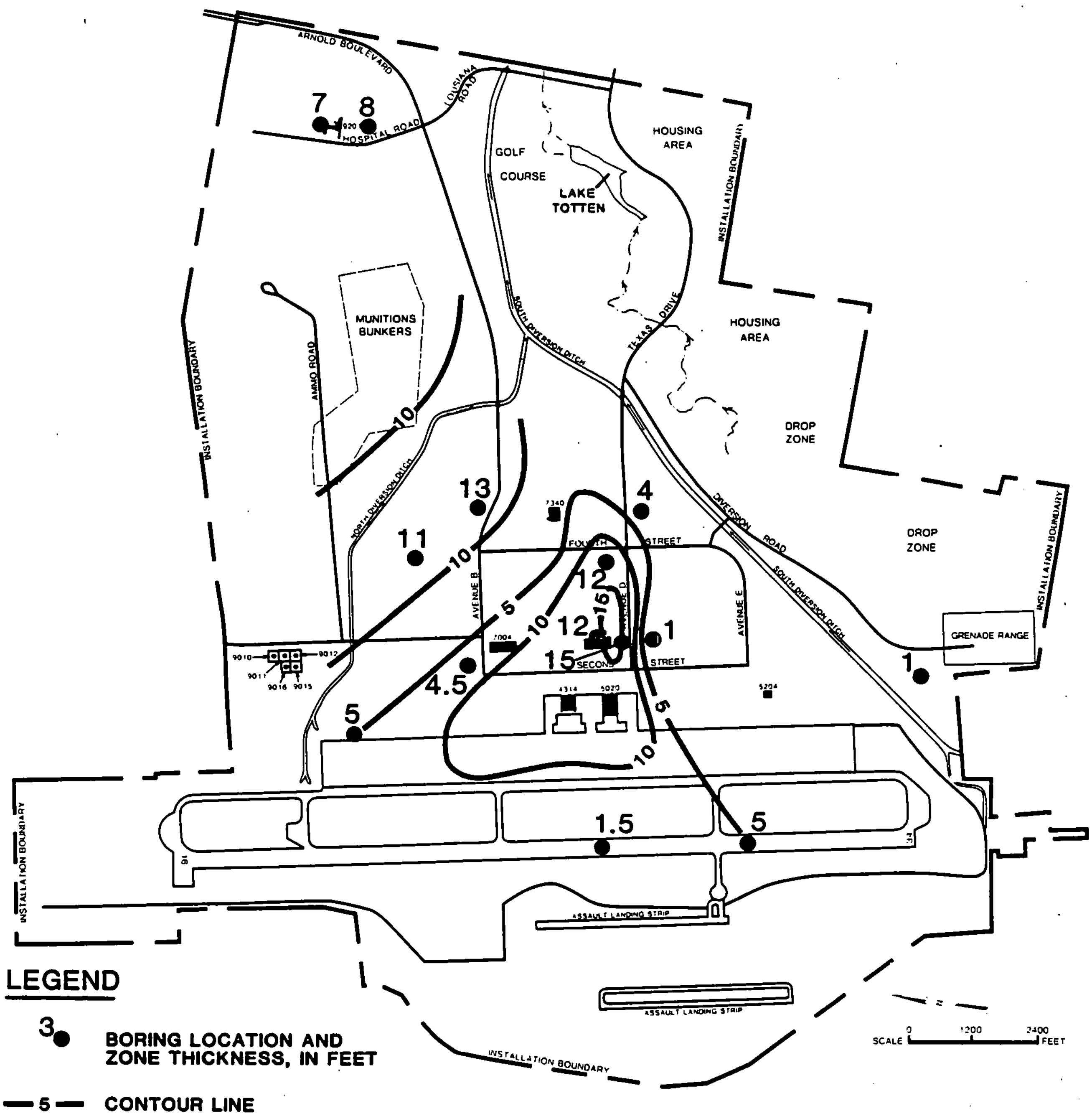
23.5 + feet: bedrock (Vale Formation)

[Ground water noted at a depth of 16.5 feet below land surface.] The sand layer or sand and gravel is not a "pure" stratum but is probably a mixture of sand, silt and gravel.

If the clayey sediments' sand and gravel zone underlies most of the base, some degree of hydraulic communication with the sand and gravel present in the lower extent of the alluvium must occur. It is therefore suggested that a single shallow aquifer may underlie a substantial portion of the Dyess AFB land area. It is most likely absent where residual soils exist (Figure 3.3). The actual extent and persistence of such a shallow aquifer can only be confirmed by on-site subsurface exploration.

Because little is known about shallow water-bearing units in the study area, an attempt was made to determine aquifer thickness and extent, using existing installation test boring information. Figure 3.7, a sand and gravel isopach map, represents an attempted correlation of the available data. The sand and gravel areas shown in Figure 3.7 suggest the shallow aquifer may extend beyond the alluvium shown in Figure 3.4. Variations in the unit's thickness may occur and it may be completely absent locally. Ground water likely occurs under water table (unconfined) or semi-artesian conditions. It is suspected that the shallow aquifer on base is recharged directly by rainfall or by infiltration through the stream beds of Little Elm Creek or its tributaries, into the alluvium. When shallow aquifer water levels are sufficiently high, discharge to local surface waters may occur (the aquifer may provide limited base flow to Little Elm Creek or its tributaries). Normally, however, the unit probably discharges to bedrock aquifers. The alluvium probably contains water continuously, as wells tapping it are given the notation "never fails" by Smith (1940). The flow directions and velocity of shallow aquifer ground water are uncertain. Because the likely water-bearing zone occurs as the basal portion of the unit just above a low-permeability bedrock, it may be assumed that local bedrock exerts a substantial influence over the direction ground water moves through the shallow aquifer. A bedrock surface elevation map,

DYESS AFB
SAND AND GRAVEL ISOPACH MAP



LEGEND

3● BORING LOCATION AND ZONE THICKNESS, IN FEET

—5— CONTOUR LINE

SOURCE: INSTALLATION DOCUMENTS

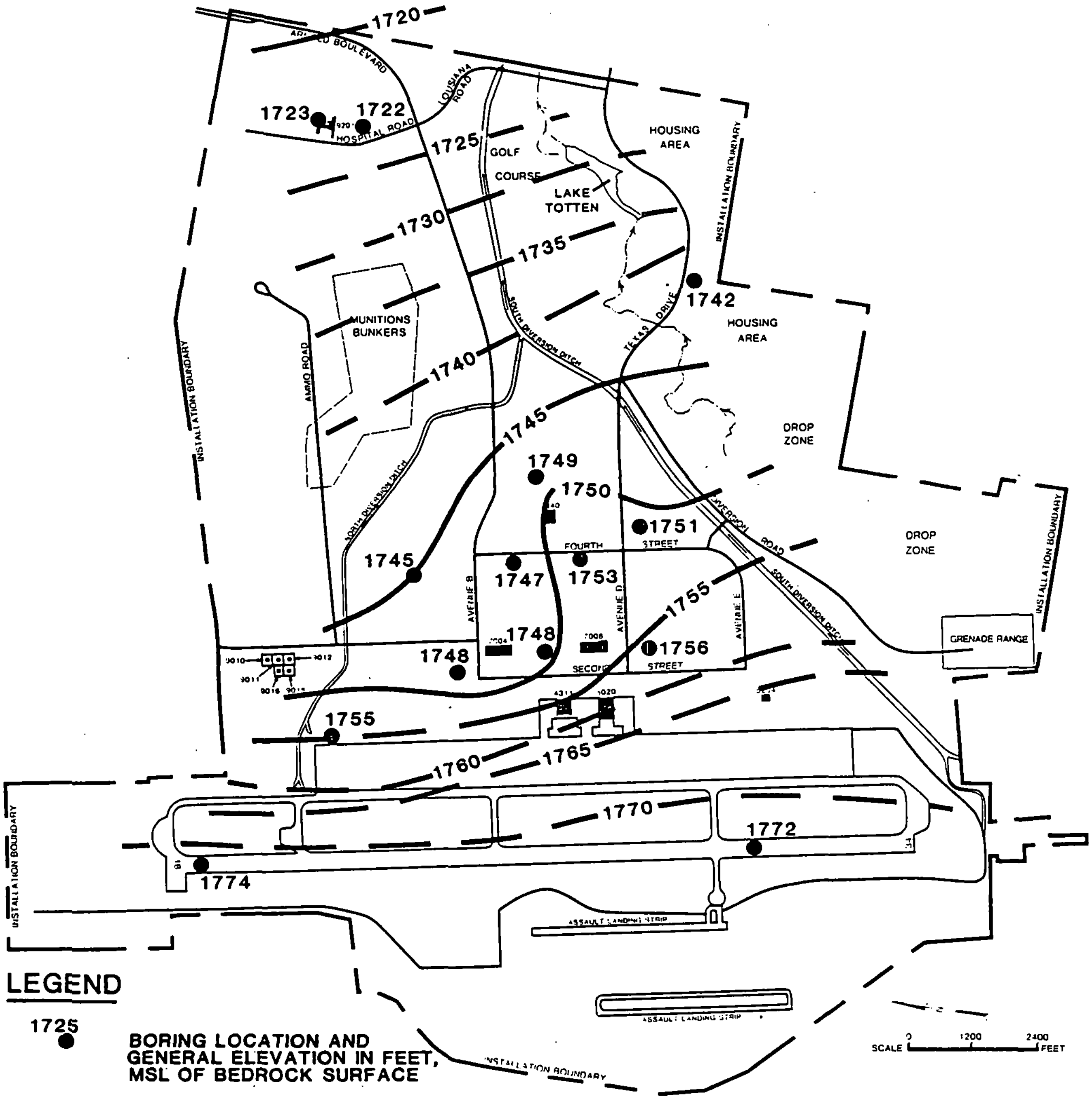
based upon installation test boring data, was prepared (Figure 3.8) in order to determine if the bedrock surface was consistent at Dyess AFB and could potentially effect ground-water flow. The bedrock surface map suggests that a gentle eastern dip occurs. An eastward or northeast shallow aquifer flow direction is indicated.

Deep Aquifer

The deep aquifer potentially available for use in the study area is the Vale Formation. The Vale includes the relatively thin (ten feet thick) Bullwagon Dolomite Member. The Vale Formation consists principally of soft red shales, with dolomite, anhydrite, clay and shaly sandstone. The unit contains ground water in secondary openings such as fractures, fissures, bedding surfaces and solution channels in the dolomite. Because of this characteristic, the unit will not readily give up water to wells, unless a sufficient number of secondary openings are interconnected by drilling.

The main source of recharge to the Vale Formation is discharge from overlying units or precipitation falling on its outcrop and thin overburden areas, such as the higher elevations of Dyess AFB. Water is contained in the Vale under artesian (confined) conditions. Ground-water flow directions and velocities in the unit are unknown. Movement of ground water in the unit is down gradient to discharge areas. The only method of discharge from the Vale is reported to be through well withdrawals (Taylor, 1978). Most wells constructed into the Vale obtain water from the Bullwagon Dolomite Member, which occurs at the top of the unit. This is because more water is available in the solution channels of the dolomite than in the fractures and fissures of the shale or the limited pore spaces of the isolated sandstones. Also, it is suspected that additional local recharge can be induced from overlying unconsolidated units (such as the alluvium) by pumping water from the top of the bedrock aquifer. Below the Bullwagon Dolomite Member, the Vale Formation becomes progressively less permeable and therefore, less suitable as a source of water supply. Taylor (1978) reports that the Vale is considered to be a source of small quantities (less than one hundred gallons per minute) of ground water in the eastern part of Taylor County. The use of the Vale Formation (or other bedrock aquifers) is

DYESS AFB
ELEVATIONS OF BEDROCK SURFACE



LEGEND

1725 ● BORING LOCATION AND GENERAL ELEVATION IN FEET, MSL OF BEDROCK SURFACE

—1740— CONTOUR LINE DASHED WHERE THE DATA ARE UNCERTAIN

SCALE 0 1200 2400 FEET

SOURCE: INSTALLATION DOCUMENTS

limited because adequate supplies of good quality water are available from surface water sources in the study area.

Study Area Ground-Water Use

Study area ground-water use is limited by several factors:

- Large quantities of good quality surface water are available at modest cost.
- A usable aquifer may not exist at a particular locality.
- The naturally poor quality of local ground water may preclude its use.

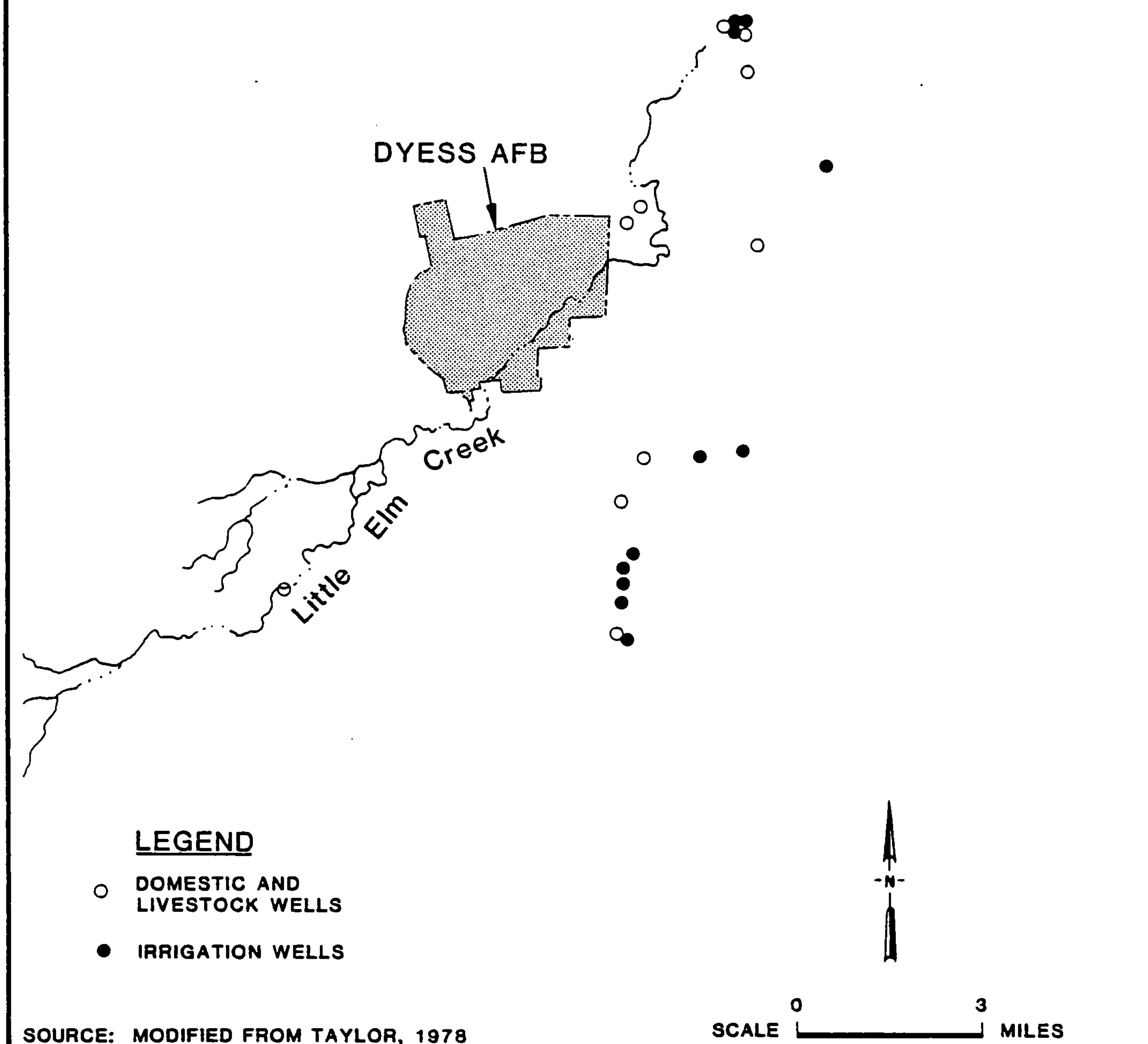
Only three privately owned wells are known to be in use near Dyess AFB, however, others may exist. Two wells, finished into the alluvium of Little Elm Creek, are located about one mile northeast of the base. A third well, located some five miles southwest of the installation, is finished into the alluvium of Elm Creek. These wells are reported to be utilized to provide small quantities of water for domestic and livestock consumption. The locations of the known wells relative to the base are shown in Figure 3.9. During the recent drought in 1983-1984, the use of surface water was restricted to conserve supplies. It has been reported that this event influenced some individuals to install small capacity wells in order to continue lawn and garden irrigation, livestock watering, swimming pool maintenance and in limited cases, for domestic consumption. The locations of these recently installed wells and the aquifers into which they are finished are unknown. An inventory of these wells would require a house-by-house inquiry in the study area.

Ground-Water Quality

Information describing the quality of study area ground water has been obtained from Smith (1940); Cronin, et al. (1963) and Taylor (1978). Generally, the quality of ground water obtained from either the Quaternary Alluvium (shallow aquifer) or the Vale Formation (deep aquifer) is highly variable and may be quite poor locally. Ground water pumped from two Little Elm Creek alluvial aquifer wells located one mile northeast of the base, had the following concentrations of inorganic parameters:

DYESS AFB

STUDY AREA WELL LOCATIONS



SOURCE: MODIFIED FROM TAYLOR, 1978

- o calcium - 49 to 68 mg/L
- o magnesium - 57 to 75 mg/L
- o sodium - 182 to 386 mg/L
- o sulfate - 168 to 335 mg/L
- o chloride - 157 to 256 mg/L
- o dissolved solids - 930 to 1,470 mg/L

Ground water may also be obtained from rocks of the Vale Formation. Study area wells installed into these rocks are usually finished at depths of less than three hundred feet due to excessive chloride concentrations that are known to exist at greater depths. Summarized Vale Formation/Bullwagon Dolomite ground-water quality falls within the following ranges:

- o calcium - 53 to 403 mg/L
- o sodium - 84 to 730 mg/L
- o sulfate - 117 to 1,080 mg/L
- o chloride - 177 to 1,510 mg/L
- o dissolved solids - 760 to 4,200 mg/L

Base Water Supplies

Dyess AFB and other major study area consumers obtain their water supplies from the City of Abilene municipal system. The city obtains water from several surface sources including Lake Abilene, Lake Fort Phantom Hill and Hubbard Creek Reservoir. Lake Fort Phantom Hill is the principal source of supply which is located ten miles northeast of the base. Lake Fort Phantom Hill is fed by Little Elm Creek and Elm Creek; it also receives diversions from Deadman Creek and supplemental pumping from the Clear Fork of the Brazos River. Lake Abilene is located on Elm Creek, about 15 miles southwest of the city, and Hubbard Creek Reservoir is situated on Hubbard Creek, approximately 45 miles northeast. The municipality furnishes ample quantities of good quality water. The quality of base water supplies is monitored routinely by the Dyess AFB Bioenvironmental Engineering Section and the City of Abilene.

Surface Water Resources

Dyess AFB is located in the Brazos River Basin of north central Texas. Installation surface water drainage is directed to Little Elm Creek and two of its unnamed tributaries, all of which extend though the base (Figure 3.2). Little Elm Creek and its unnamed tributaries are ephemeral streams that only flow during part of the year when sufficient runoff is available. When flowing, Little Elm Creek drains to Elm Creek, which in turn, drains to Lake Fort Phantom Hill, a water supply reservoir located some ten miles northeast of the base in Jones County. The other reservoirs and lakes serving Abilene for water supply are not located downstream of the base. Neither Little Elm Creek nor Lake Totten (base surface waters) is identified in Texas Surface Water Quality Standards (Texas Administrative Code, 1984). However, compliance with the water quality "General Criteria" (Texas Administrative Code, Section 333.15) is required for all waters of the state at all times and is specifically applicable to wastewater discharges. The General Criteria are included in Appendix D. Lake Fort Phantom Hill is identified in the Texas Surface Water Quality Standards as Brazos River Basin segment number 1236. Lake Fort Phantom Hill is considered suitable for contact and non-contact recreation, fish and wildlife propagation and as a source of domestic raw water supply. The maximum values for constituents utilized to maintain reservoir quality include:

- o chloride: 200 mg/L
- o sulfate: 100 mg/L
- o total dissolved solids: 600 mg/L
- o dissolved oxygen: 5 mg/L or greater
- o pH: 6.5-9.0 units
- o Fecal coliform bacteria: 200/100 mL

Discharges into area streams which then drain into Lake Fort Phantom Hill must not degrade the quality of the reservoir to a point less than the above specified standards.

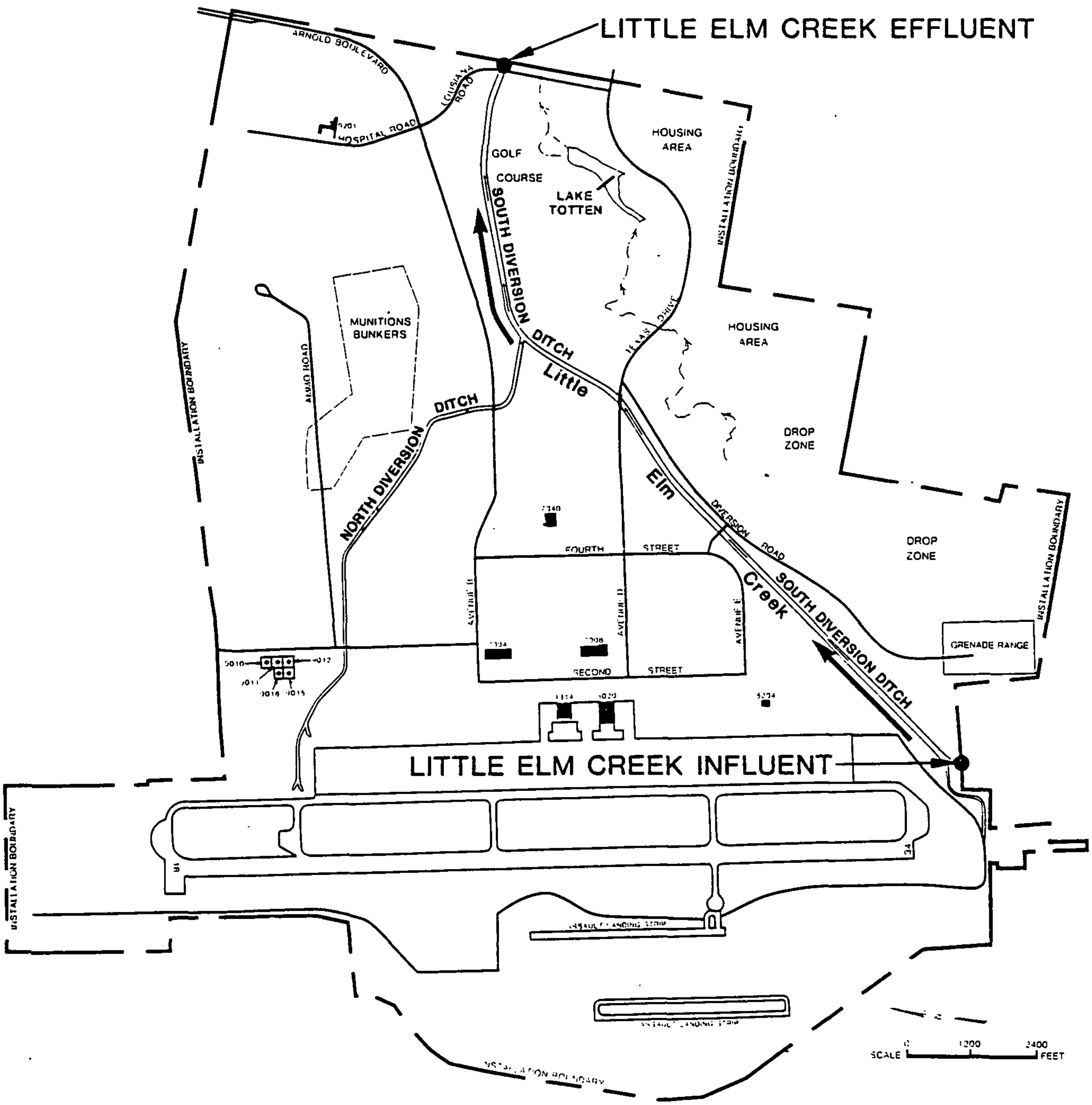
Surface Water Quality Monitoring

Surface water quality monitoring has been conducted at Dyess AFB at the locations shown in Figure 3.10. Because the streams flowing on the

FIGURE 3.10

DYESS AFB

SURFACE WATER SAMPLING LOCATIONS



SOURCE: INSTALLATION DOCUMENTS

installation do so intermittently, sampling and subsequent analyses have been conducted in a like manner. A review of base historical water quality sampling data (1977-1982) indicates that base water quality has been acceptable. A comparison of data for Little Elm Creek as it enters and leaves the base suggests that installation activities (on the sampling dates) did not degrade the quality of the stream's water. The quality usually complied with the requirements of the surface water designations to which it is assigned.

THREATENED AND ENDANGERED SPECIES

The land area of Dyess AFB includes over 5,000 acres of which approximately one-half is classified as unimproved property. The unimproved sections are primarily limited to the areas just north and south of Ammo Road, the area south of Little Elm Creek (South Diversion Ditch) and the area surrounding the assault landing strips (old Tye Airfield). Small isolated fields are located throughout the installation.

Two wetland zones have been identified on base. One is associated with the North Diversion Ditch and the other is located along the modified course of Little Elm Creek (South Diversion Ditch). Base vegetation consists of common varieties of grasses and weeds and several types of trees including mesquite, elm, hackberry, willow and live oak. This mixture of vegetation provides suitable habitat to an assortment of small animals, birds and insects.

No threatened or endangered animal species is known to be in permanent residence at Dyess AFB. However, the Peregrine Falcon, a federal endangered species, has been reported to be a periodic visitor to the installation during the period December through March and has been observed in the vicinity of the base water tower (HQSAC, 1983). The base is also within the range of the Bald Eagle (federal endangered species). The Interior Least Fern, a species considered endangered by the state, has had seasonal occurrence in the area.

SUMMARY OF ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation indicate that the following elements are relevant to the evaluation of past hazardous waste management practices at Dyess AFB:

- The mean annual precipitation is 25.3 inches and net annual precipitation is calculated to be minus 43 inches.
- Localized flooding may occur on the base in the areas adjacent to the North Diversion Ditch and Little Elm Creek (South Diversion Ditch).
- Wetlands (North and South Diversion Ditches) have been identified on the installation.
- Base upland surface soils are predominantly clayey and possess low permabilities. They are underlain by more permeable sand and gravel. Soils present in the channels of base streams are silty sands and are somewhat more permeable. Extensive sand and gravel zones probably underlie the stream channel materials.
- Two aquifers of minor importance probably exist on base. A shallow aquifer, present at or near land surface, is composed of a basal sand and gravel in upland clayey sediments and a sand and gravel zone is likely present in the lower extent of stream channel alluvium. A bedrock aquifer also underlies the base.
- Shallow aquifer ground water was encountered at the base hospital at a depth of some sixteen feet below land surface. The depth to water in the deep (rock) aquifer is unknown.
- The shallow aquifer (and probably the deep aquifer) receive recharge from precipitation or infiltration through streambeds within the base boundaries.
- All of the water-bearing zones identified on base probably communicate hydraulically to some degree. During periods when area water levels are highest, the shallow aquifer likely discharges (provides base flow) to local streams.

- The shallow aquifer identified on base has been reported to be a source of water supplies to two consumers located one mile downstream (down gradient) from Dyess AFB.
- The vast majority of study area consumers, both institutional and individual, obtain potable water supplies from the City of Abilene municipal system. The Abilene system obtains its water supplies from several lakes and reservoirs. Lake Fort Phantom Hill, located ten miles northeast of the base, is the principal source of supply. The reservoir potentially receives some base drainage via Little Elm Creek and Elm Creek.
- Historic water quality data indicates that base surface water conforms to the standard required for the designated use classifications of local streams.
- Little Elm Creek and its unnamed tributaries on base are ephemeral streams; they contain moving water only when sufficient runoff is available to support flow.
- The Peregrine Falcon, a rare and endangered animal species, has been reported to be a periodic transient at the base.

It may be seen from these key environmental factors that potential pathways facilitating the migration of hazardous waste-related contamination exist. Hazardous waste constituents present at ground surface could potentially be mobilized to the shallow aquifer on base and subsequently to the communicating deep aquifer, or directly to local surface waters.

SECTION 4

FINDINGS

This section summarizes the hazardous wastes generated by installation activities, identifies hazardous waste accumulation and disposal sites located on the installation, and evaluates the potential environmental contamination from hazardous waste sites. Past waste generation and disposal methods were reviewed to assess the potential for contamination at various sites at Dyess AFB.

SATELLITE ANNEXES REVIEW

All of the communications and navigational aid annexes at Dyess are unmanned facilities. Utilities such as water and sewer are not provided. Solid waste generated by personnel visiting the sites for monitoring or maintenance is transported back to Dyess. No waste has been disposed at the satellite annexes.

The transmitter annex has an above ground 500 gallon diesel fuel tank which serves a standby power generator. A 1000 gallon underground tank stores heating fuel oil for the transmitter facilities. The receiver annex has an above ground diesel fuel tank for standby power generation and a 1000 gallon underground heating oil tank. There were no reported fuel system leaks or spills at the transmitter and receiver sites. None of the navigational aid annexes for Dyess AFB have any fuel tanks.

INSTALLATION HAZARDOUS WASTE ACTIVITY REVIEW

A review was made of past installation activities that resulted in generation, accumulation and disposal of hazardous wastes. Information was obtained from files and records, interviews with past and present installation employees and site inspections.

Sources or activities involving potential release of hazardous waste at Dyess AFB are grouped into the following categories:

- o Industrial Operations (Shops)
- o Waste Accumulation Areas
- o Fuels Management
- o Spills and Leaks
- o Pesticide Utilization
- o Fire Protection Training

The subsequent discussion addresses only those wastes generated at Dyess AFB which are either hazardous or potentially hazardous. Potentially hazardous wastes are grouped with and referenced as "hazardous wastes" throughout this report. A hazardous waste, for this report, is defined by, but not limited to, The Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) (see Appendix I). Compounds such as polychlorinated biphenyls (PCB) which are listed in the Toxic Substances Control Act (TSCA) are also considered hazardous. For study purposes, waste petroleum products such as contaminated fuels, waste oils and waste nonchlorinated solvents are also included in the "hazardous waste" category. It is noted, however, that waste oil is not designated a hazardous waste under Texas or USEPA regulations.

No distinction is made in this report between "hazardous substances/materials" and "hazardous wastes". A potentially hazardous waste is one which is suspected of being hazardous although insufficient data are available to fully characterize the material.

<u>Industrial Operations (Shops)</u>

Summaries of industrial operations at Dyess AFB were developed from Bioenvironmental Engineering Section and Civil Engineering files. These data were supplemented by conducting interviews with shop personnel. Information obtained was used to determine which operations handle hazardous materials and which ones generate hazardous wastes. Summary information on all installation shops is provided as Appendix E, Master List of Shops.

For the shops identified as generating hazardous wastes, file data was reviewed and personnel were interviewed to determine the types and quantities of materials and present and past disposal methods. Information developed from base files and interviews with installation employees is summarized in Table 4.1. The table includes a listing of the types of hazardous wastes generated at the various shops, estimates of current waste quantities, and timelines showing the waste disposal methods. Table 4.1 does not include the shops which generate minor quantities of hazardous waste.

The industrial operations at Dyess AFB consist primarily of aircraft and vehicle maintenance and repair activities. These and other support operations generate potentially hazardous wastes at a number of shops. The wastes generated at Dyess AFB consist mainly of contaminated aircraft fuel (JP-4), spent oils and lubricants, hydraulic fluids, solvents, paints and thinners.

For the past four to five years most shops have disposed of hazardous wastes through the Defense Property Disposal Office (DPDO). From the 1960's to early 1980's oils and hydraulic fluids have generally been stored on base and then hauled by a contractor to off base disposal or recycling operations. These waste petroleum products were predominantly stored in a buried railroad tank car located at the southern edge of the base. For a number of years (late 1950's or early 1960's to the late 1970's) waste oils and solvents were disposed of at an evaporation pit located close to the buried railroad tank car. Small quantities of hazardous wastes likely went to the base landfill, particularly in the 1950's and early 1960's prior to use of the evaporation pit and installation of the railroad tank car. In the 1950's and 1960's combustible wastes were regularly taken to fire protection training areas for use in training exercises; however, in the 1970's cleaner fuels were utilized and most combustible wastes were diverted to other disposal methods. Runoff from aircraft and vehicle washracks and engine test areas as well as uncontrolled discharges from various shops has entered the surface drainage system. Installation of several oil-water separators to control shop wastes entering the storm system has occurred in recent years.

TABLE 4.1
INDUSTRIAL OPERATIONS (Shops)
Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY*	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 1960 1970 1980)
96TH BOMBARDMENT WING				
96TH AVIONICS MAINTENANCE SQUADRON (AMS)				
DEFENSIVE AVIONICS	5005	DIELECTRIC COOLING FLUID	55 GALS./YR.	1955 LEACHING PIT/TANK 1982 DPDO
FIRE CONTROL	5005	PD-680	60 GALS./YR.	LEACHING PIT DPDO
		TRICHLOROETHYLENE	200 GALS./YR.	LEACHING PIT DPDO
PMEL-TMDE	7008	MERCURY	10 LBS./YR.	1965 DPDO
96TH FIELD MAINTENANCE SQUADRON (FMS)				
CORROSION CONTROL	5003	PAINTS, PRIMERS, LACQUERS, TOLUENE, THINNERS, METHYL ETHYL KETONE (MEK)	660 GALS./YR.	1955 FPTA DPDO
		PAINT SLUDGE	25 GALS./YR.	LANDFILL 1972 OBCR
		PAINT STRIPPERS	370 GALS./YR.	FPTA DPDO
		STRIPPER IN RINSEWATER	10 GALS./YR.	SANITARY SEWER

KEY
- ——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL
- - - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL
- *AS OF 1984

OBCR - OFF-BASE CONTRACTOR REMOVAL

DPDO - DEFENSE PROPERTY DISPOSAL OFFICE

TANK - TO UNDERGROUND RR TANK CAR AT LANDFILL AND THEN OBCR

FPTA - FIRE PROTECTION TRAINING AREA

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY*	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1960 – 1970 – 1980)
NDI	5004	PD-680	80 GALS./YR.	1959 LEACHING PIT/TANK → 1978 DPDO →
		PENETRANT (OIL BASE) AND EMULSIFIER	200 GALS./YR.	LEACHING PIT/ TANK → DPDO →
		ENGINE OIL	130 GALS./YR.	LEACHING PIT/LANDFILL → DPDO →
		DEVELOPERS	60 GALS./YR.	SANITARY SEWER →
		FIXERS	40 GALS./YR.	SILVER RECOVERY/SANITARY SEWER →
PROPULSION (ENGINE)	4311	PD-680	330 GALS./YR.	1955 LEACHING PIT/LANDFILL → 1972 LEACHING PIT → 1981 DPDO →
		ENGINE OIL	660 GALS./YR.	LEACHING PIT/LANDFILL → LEACHING PIT → DPDO →
		CARBON REMOVER	330 GALS./YR.	LEACHING PIT/LANDFILL → LEACHING PIT → DPDO →
ENGINE TEST CELL	5305	JP-4	220 GALS./YR.	FPTA →
		HYDRAULIC FLUID	110 GALS./YR.	LEACHING PIT/LANDFILL → 1972 LEACHING PIT → 1981 DPDO →
		ENGINE OIL & PRESERVATIVE	440 GALS./YR.	LEACHING PIT/LANDFILL → LEACHING PIT → DPDO →
		PD-680	55 GALS./YR.	LEACHING PIT/LANDFILL → LEACHING PIT → DPDO →
		JP-4/OIL MIXTURE	660 GALS./YR.	FPTA →
REPAIR/RECLAMATION AND WHEEL & TIRE	5020	PD-680	780 GALS./YR.	LEACHING PIT/TANK → 1980 DPDO →

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

*AS OF 1984

OBCR – OFF-BASE CONTRACTOR REMOVAL

DPDO – DEFENSE PROPERTY DISPOSAL OFFICE

TANK – TO UNDERGROUND RR TANK CAR AT LANDFILL AND THEN OBCR

FPTA – FIRE PROTECTION TRAINING AREA

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY*	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
FUEL SYSTEMS	4314	JP-4	3,200 GALS./YR.	1955 REUSED
		JP-4	400 GALS./YR.	FPTA
ELECTRICAL SYSTEMS	4309	SULFURIC ACID	310 GALS./YR.	NEUTRALIZED/SANITARY SEWER
		POTASSIUM HYDROXIDE	50 GALS./YR.	NEUTRALIZED/SANITARY SEWER
		BATTERY CASES/CELLS	560 CASES/YR.	DPDO
PNEUDRAULICS	4309	HYDRAULIC FLUID	660 GALS./YR.	LEACHING PIT/TANK; DPDO 1982
		PD-680	660 GALS./YR.	LEACHING PIT/TANK; DPDO
AGE	4314	ENGINE OIL	440 GALS./YR.	LEACHING PIT; 1980 DPDO
		HYDRAULIC FLUID	200 GALS./YR.	LEACHING PIT; DPDO
		STEAM TURBINE OIL	80 GALS./YR.	LEACHING PIT; DPDO 1982
		SYNTHETIC TURBINE OIL	60 GALS./YR.	LEACHING PIT; 1980 DPDO
		PD-680	120 GALS./YR.	LEACHING PIT; DPDO 1982
		DETERGENT & PD-680 (WASH RACK)	10 GALS./YR.	STORM SEWER

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

*AS OF 1984

OBCR - OFF-BASE CONTRACTOR REMOVAL

DPDO - DEFENSE PROPERTY DISPOSAL OFFICE

TANK - TO UNDERGROUND RR TANK CAR AT LANDFILL AND THEN OBCR

FPTA - FIRE PROTECTION TRAINING AREA

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY*	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 1960 1970 1980)
96TH MUNITIONS MAINTENANCE SQUADRON (MMS)				
NUCLEAR MAINTENANCE	9110	SOLVENTS	3 GALS./YR.	1955 LEACHING PIT/TANK → 1981 DPDO
CONVENTIONAL MAINTENANCE	9113	RAGS WITH PD-680	3 CU. FT./YR.	LANDFILL → 1972 OBCR → DPDO
EXPLOSIVE ORDNANCE DISPOSAL	9115	MUNITIONS	360 LBS./YR.	COMBUSTION AND BURIAL
MISSILE CHECKOUT/SRAM	9112	HYDRAULIC FLUID	10 GALS./YR.	DPDO 1982 1984
		SOLVENTS	3 GALS./YR.	DPDO
EQUIPMENT MAINTENANCE (PREVIOUSLY BLDG. 8040)	5204	HYDRAULIC FLUID	600 GALS./YR.	TANK → DPDO → OIL/WATER SEPARATOR/SANITARY SEWER
		WASTE OIL	120 GALS./YR.	TANK → DPDO → OIL/WATER SEPARATOR/SANITARY SEWER
		PD-680	120 GALS./YR.	TANK → 1978 DPDO → OIL/WATER SEPARATOR/SANITARY SEWER
96TH ORGANIZATIONAL MAINTENANCE SQUADRON (OMS)				
NON-POWERED AGE	5121	HYDRAULIC FLUID	50 GALS./YR.	TANK → DPDO
		PD-680	50 GALS./YR.	TANK → DPDO
TRANSIENT AIRCRAFT	9001	FUEL AND OIL	5 GALS./YR.	FPTA → DPDO/FPTA

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

*AS OF 1984

OBCR - OFF-BASE CONTRACTOR REMOVAL

DPDO - DEFENSE PROPERTY DISPOSAL OFFICE

TANK - TO UNDERGROUND RR TANK CAR AT LANDFILL AND THEN OBCR

FPTA - FIRE PROTECTION TRAINING AREA

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY*	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
96TH TRANSPORTATION SQUADRON (TRANS)				
VEHICLE, FIRE TRUCK AND REFUELING TRUCK MAINTENANCE; ALLIED TRADES	8015, 4003, 4116	ENGINE OIL	1,320 GALS./YR.	1955 TANK → 1980 DPDO
		HYDRAULIC FLUID	330 GALS./YR.	TANK → DPDO
		PD-680	220 GALS./YR.	TANK → DPDO
		CARBON REMOVER	10 GALS./YR.	TANK → DPDO
		THINNERS, WASTE PAINT	15 GALS./YR.	TANK → DPDO
		JP-4	1,700 GALS./YR.	FPTA
		SULFURIC ACID	260 GALS./YR.	NEUTRALIZED/SANITARY SEWER
		BATTERY CASES	240 CASES/YR.	DPDO
96TH COMBAT SUPPORT GROUP (CSG)				
PHOTO LABORATORY	7312	DEVELOPER	650 GALS./YR.	SANITARY SEWER
		FIXER	350 GALS./YR.	SANITARY SEWER → 1969 SILVER RECOVERY/SANITARY SEWER
AUTO HOBBY SHOP	7101	ENGINE OIL AND HYDRAULIC FLUID	1,200 GALS./YR.	LEACHING PIT/TANK → 1974 OBCR

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

*AS OF 1984

OBCR - OFF-BASE CONTRACTOR REMOVAL

DPDO - DEFENSE PROPERTY DISPOSAL OFFICE

TANK - TO UNDERGROUND RR TANK CAR AT LANDFILL AND THEN OBCR

FPTA - FIRE PROTECTION TRAINING AREA

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY*	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1960 – 1970 – 1980)
96TH CIVIL ENGINEERING SQUADRON (CES)				
PROTECTIVE COATING	8007	PAINT, MINERAL SPIRITS, LACQUER THINNER, TOULENE	330 GALS./YR.	1955 TO GROUND (RANDOM SITES ON BASE) 1982 DPDO
REFRIGERATION	8008	COMPRESSOR LUBRICATING OIL	80 GALS./YR.	GROUND/SANITARY SEWER
		ACID CLEANER (DILUTED)	75 GALS./YR.	GROUND/SANITARY SEWER
LIQUID FUELS MAINTENANCE	4116	POL TANK CLEANING SLUDGE	80 GALS./YR.	1958 WEATHERED ON GROUND
EXTERIOR ELECTRIC	8008	TRANSFORMER OIL	150 GALS./YR.	1955 LEACHING PIT/TANK 1972 DPDO
		CIRCUIT BREAKER OIL	75 GALS./YR.	LEACHING PIT/TANK DPDO
		CAPACITORS WITH OIL	2 CAPACITORS/YR.	DPDO
		TRANSFORMERS	35 TRANSFORMERS/YR.	DPDO
POWER PRODUCTION	8008	ENGINE OIL	300 GALS./YR.	FPTA/TANK 1979 DPDO
		DIESEL FUEL	60 GALS./YR.	FPTA/TANK DPDO
		SULFURIC ACID	350 GALS./YR.	NEUTRALIZED/SANITARY SEWER
		BATTERY CASES	100 CASES/YR.	DPDO
		FUEL/WATER MIXTURE	200 GALS./YR.	FPTA

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

*AS OF 1984

OBCR - OFF-BASE CONTRACTOR REMOVAL

DPDO - DEFENSE PROPERTY DISPOSAL OFFICE

TANK - TO UNDERGROUND RR TANK CAR AT LANDFILL AND THEN OBCR

FPTA - FIRE PROTECTION TRAINING AREA

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY*	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
ENTOMOLOGY	8009	PESTICIDE CONTAINERS AND BAGS	4 CONTAINERS/YR.	1955 LANDFILL 1972 OBCR
GOLF COURSE MAINTENANCE	11975	ENGINE OIL	20 GALS./YR.	GROUND/FPTA DPDO
		PESTICIDE BAGS	600 BAGS/YR.	LANDFILL 1972 OBCR
USAF HOSPITAL DYESS				
RADIOLOGY	9201	DEVELOPER	360 GALS./YR.	1956 SANITARY SEWER
		FIXER	360 GALS./YR.	SILVER RECOVERY/SANITARY SEWER SANITARY SEWER 1983
DENTAL CLINIC	6133, 9201	DEVELOPER	100 GALS./YR.	SANITARY SEWER
		FIXER	100 GALS./YR.	SILVER RECOVERY/SANITARY SEWER SANITARY SEWER 1980
TENANT ORGANIZATIONS				
463RD TACTICAL AIRLIFT WING (MAC)				
463RD FIELD MAINTENANCE SQUADRON (FMS)				
CORROSION CONTROL	5003	PAINTS, PRIMER, LACQUERS, TOLUENE, THINNERS, METHYL ETHYL KETONE (MEK)	1,320 GALS./YR.	1955 FPTA 1982 DPDO
		PAINT SLUDGE	50 GALS./YR.	LANDFILL OBCR
		PAINT STRIPPERS	730 GALS./YR.	FPTA DPDO
		STRIPPER IN RINSEWATER	15 GALS./YR.	SANITARY SEWER

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

------ ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

*AS OF 1984

OBCR - OFF-BASE CONTRACTOR REMOVAL

DPDO - DEFENSE PROPERTY DISPOSAL OFFICE

TANK - TO UNDERGROUND RR TANK CAR AT LANDFILL AND THEN OBCR

FPTA - FIRE PROTECTION TRAINING AREA

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY*	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1960 – 1970 – 1980)
PROPULSION (ENGINE/PROPELLOR)	4311	JP-4	200 GALS./YR.	1956 ---- FPTA ——→
		HYDRAULIC FLUID	1,430 GALS./YR.	---- OBCR ----→ DPDO →
		ENGINE OIL	1,430 GALS./YR.	---- OBCR ----→ DPDO →
		PD-680	300 GALS./YR.	---- OBCR ----→ DPDO →
		AIRCRAFT CLEANING SOAP	1200 GALS./YR.	---- SANITARY SEWER ----→
ENGINE TEST CELL	5300	JP-4	55 GALS./YR.	---- FPTA/SURFACE DRAINS ----→ FPTA →
REPAIR/RECLAMATION AND WHEEL & TIRE	5020	PD-680	1,560 GALS./YR.	1955 ---- LEACHING PIT/TANK ----→ 1980 DPDO →
FUEL SYSTEMS	4301, 4311	JP-4	1,800 GALS./YR.	---- TO 463RD NON-POWERED AGE ----→
PNEUDRAULICS	5020	HYDRAULIC FLUID	600 GALS./YR.	1956 ---- LEACHING PIT/TANK ----→ 1980 DPDO →
		PD-680	200 GALS./YR.	---- LEACHING PIT/TANK ----→ DPDO →
REFURBISHING HANGAR	5017	PAINTS, LACQUERS, THINNER, METHYL ETHYL KETONE (MEK)*	660 GALS./YR.*	---- FPTA ----→ 1983 DPDO →
AGE	4314	ENGINE OIL	880 GALS./YR.	---- LEACHING PIT ----→ DPDO →
		HYDRAULIC FLUID	400 GALS./YR.	---- LEACHING PIT ----→ DPDO →
		STEAM TURBINE OIL	160 GALS./YR.	---- LEACHING PIT ----→ DPDO →
		SYNTHETIC TURBINE OIL	120 GALS./YR.	---- LEACHING PIT ----→ DPDO →
		PD-680	240 GALS./YR.	---- LEACHING PIT ----→ DPDO →

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

------ ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

* PRIOR TO 1983 THESE WASTES CAME FROM CORROSION CONTROL (BLDG. 5003)

OBCR - OFF-BASE CONTRACTOR REMOVAL

DPDO - DEFENSE PROPERTY DISPOSAL OFFICE

TANK - TO UNDERGROUND RR TANK CAR AT LANDFILL AND THEN OBCR

FPTA - FIRE PROTECTION TRAINING AREA

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY*	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 1960 1970 1980)
AGE (CONT'D)	4314	DETERGENT & PD-680 (WASH RACK)	10 GALS./YR.	1955 STORM SEWER
463RD ORGANIZATIONAL MAINTENANCE SQUADRON (OMS)				
NON-POWERED AGE	4318	JP-4	8,100 GALS./YR.	REUSED
		JP-4	900 GALS./YR.	FPTA
		ENGINE OIL	660 GALS./YR.	TANK 1977 DPDO
		HYDRAULIC OIL	660 GALS./YR.	TANK DPDO
		PD-680	180 GALS./YR.	TANK DPDO
AIRCRAFT WASH RACK	4222, 4220	PD-680	2,640 GALS./YR.	OIL/WATER SEPARATOR/ SURFACE DRAINS 1982
		DETERGENT	11,000 GALS./YR.	1982 SANITARY SEWER
1ST MOBILE AERIAL PORT SQUADRON (MAPS)				
VEHICLE MAINTENANCE	4314	ENGINE OIL AND HYDRAULIC FLUID	110 GALS./YR.	1972 TANK 1983 DPDO
		DIESEL FLUID	10 GALS./YR.	TANK DPDO
DETACHMENT 1, 47TH FIELD TRAINING WING (ACE)				
FLIGHT MAINTENANCE	5015	ENGINE OIL	2 GALS./YR.	TANK 1979 DPDO 1980

KEY

———— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

*AS OF 1984

OBCR OFF-BASE CONTRACTOR REMOVAL

DPDO DEFENSE PROPERTY DISPOSAL OFFICE

TANK - TO UNDERGROUND RR TANK CAR AT LANDFILL AND THEN OBCR

FPTA FIRE PROTECTION TRAINING AREA

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY*	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 1960 1970 1980)
1993RD INFORMATION SYSTEMS SQUADRON (ISS)				
NAVAID MAINTENANCE	7008, 8015	ENGINE OIL	3 GALS./YR.	1955 - - - TANK - - - 1980 → DPDO
		SULFURIC ACID	3 GALS./YR.	1979 → NEUTRALIZED/SANITARY SEWER
		BATTERY CASES	2 CASES/YR.	DPDO →
ARMY AND AIR FORCE EXCHANGE SERVICE (AAFES)				
BX SERVICE STATION	7325	ENGINE OIL	2,400 GALS./YR.	1956 - - - OBCR - - - →

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

*AS OF 1984

OBCR - OFF-BASE CONTRACTOR REMOVAL

DPDO - DEFENSE PROPERTY DISPOSAL OFFICE

TANK - TO UNDERGROUND RR TANK CAR AT LANDFILL AND THEN OBCR

FPTA - FIRE PROTECTION TRAINING AREA

Waste Accumulation Areas

Currently most hazardous wastes and recyclable petroleum products generated in the shops are collected at one of sixteen accumulation points established on base. Wastes are transported to DPDO for storage and disposal by contract. Figure 4.1 shows the accumulation areas currently in use and one previous accumulation point. Some of the sites accumulate only petroleum products which are recyclable, while others accumulate hazardous wastes requiring disposal through DPDO. A few accumulate both types of wastes. Most of the accumulated wastes are currently picked up at DPDO by an outside contractor and disposed of off base. Some minor spillage has occurred at a few sites, however major leaks and spills have not been indicated.

Thirteen of the waste accumulation areas are at-grade facilities and three are underground tanks. The BX Service Station and Auto Hobby Shop both have 500-gallon tanks to store waste oils. A 10,000-gallon tank at the Motor Pool is used to store contaminated JP-4 from various flightline shops prior to use at the fire protection training area. There are no known leaks from the three waste storage tanks.

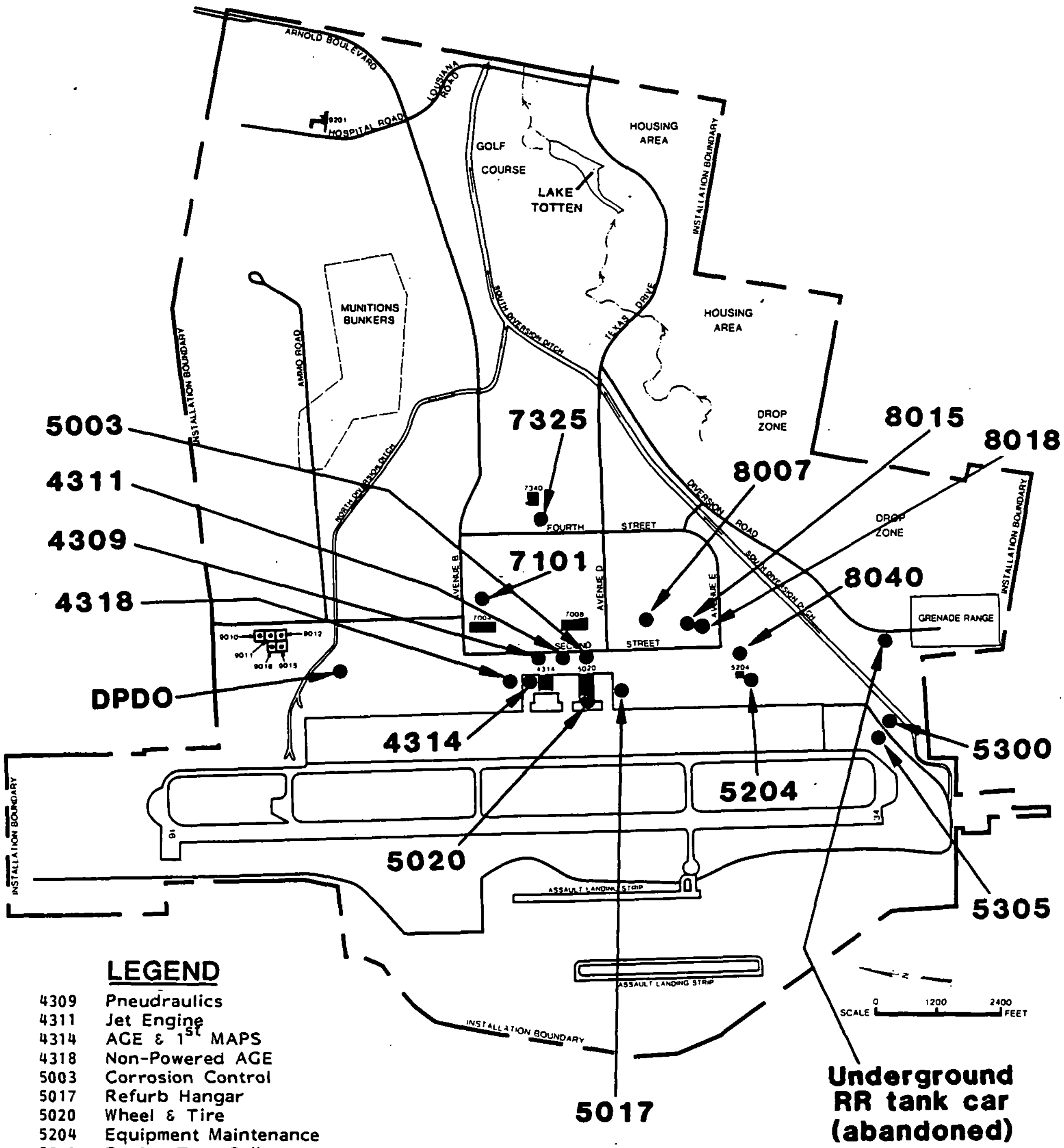
Up until 1982, a 10,000-gallon railroad tank car buried near the grenade range (Figure 4.1) was used as the main base waste accumulation point. This facility (discussed later in this section) is no longer in use.

Fuels Management

The fuels management system at Dyess AFB consists of over 130 storage tanks located throughout the base. Appendix D includes a listing of all known tanks used for storing jet fuel (JP-4), vehicle gasoline (MOGAS), diesel fuel, fuel oil, waste fuel and waste oils. The summary in Appendix D identifies the tank by facility number, product stored, storage capacity, tank construction (above or below ground) and also notes if the tank is active or inactive.

All bulk aviation fuels are delivered to the base by pipeline. Rail and/or truck transport serve as a backup. Fuel from the aboveground, bermed bulk storage tanks (9010, 9011, 9012, 9015 and 9016) is transferred to a series of buried operational tanks along the flightline. Pumping stations then supply a flightline hydrant fueling system

DYESS AFB
WASTE ACCUMULATION AREAS



LEGEND

4309	Pneudraulics
4311	Jet Engine
4314	AGE & 1st MAPS
4318	Non-Powered AGE
5003	Corrosion Control
5017	Refurb Hangar
5020	Wheel & Tire
5204	Equipment Maintenance
5300	Engine Test Cell
5305	Engine Test Cell
8007	CE Paint
8015	Vehicle Maintenance
8040	Non-Powered AGE
7101	Auto Hobby (underground tank)
7325	BX Service Station (underground tank)
8018	Motor Pool (underground tank)
----	RR tank car (underground tank - abandoned)

NOTE: THESE LOCATIONS WERE CURRENT AS OF 1984.

SOURCE: INSTALLATION DOCUMENTS

for the aircraft. Delivery of diesel fuel, fuel oil, and MOGAS to various tanks on base is by truck. There have been no major spills or leaks from the pipeline or truck fuel delivery systems.

All bulk and operational aviation fuel tanks are internally inspected on four and three year cycles, respectively. Other base storage tanks are checked for leaks through inventory records. Spills and leaks are discussed subsequently in this section.

Sludge removed from the bulk and operational fuel tanks during internal inspection and cleaning has been disposed at three locations since the base started. Figure 4.2 shows the disposal areas. From 1958 to 1967 the POL sludge was weathered on the ground just outside the bermed area for the bulk storage tanks (Site No. 1). Sludge was then weathered at the existing grenade range (Site No. 2) for about ten years (1967-1978). For the past several years (1978-1984) sludge has been disposed adjacent to one of the hydrant pumping stations (Facility 5402).

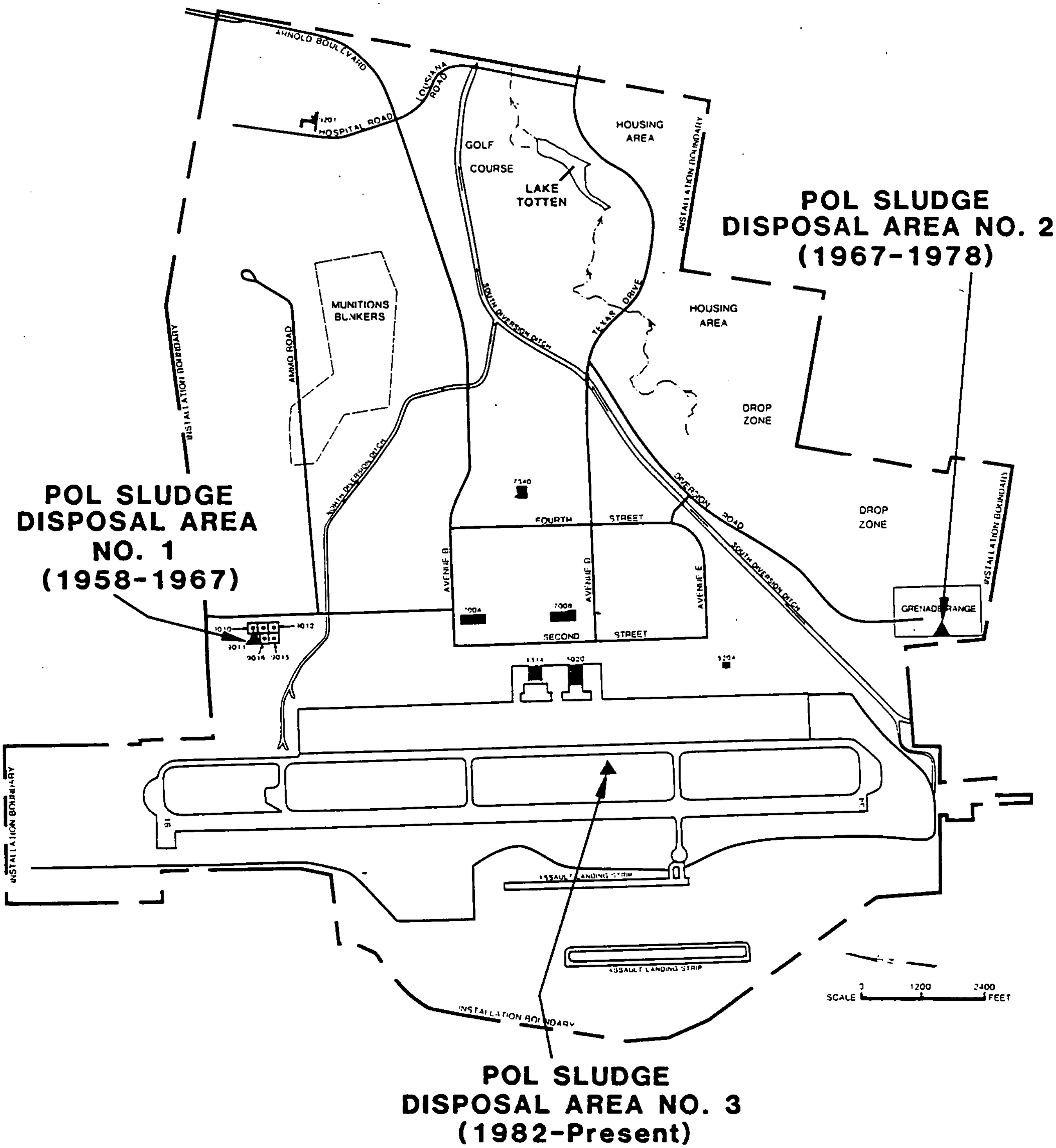
Spills and Leaks

Numerous small spills and leaks have occurred at the base, primarily on the flightline. In the past, the small spills evaporated on the ground/pavement, were picked up with absorbents, or were flushed to storm drains by the fire department. Spills of small quantities of shop wastes have also occurred with drainage to sanitary or storm sewers.

About 1000 gallons of JP-4 was spilled at the bulk storage tanks in 1970. This fuel flowed out of the diked area and into the nearby drainage channel. In 1974, a spill/leak of about 5000 gallons of JP-4 occurred within the bermed area at the 9010 bulk storage tank. A high percentage of this fuel was recovered. A loss of an estimated 3,000 to 4,000 gallons of JP-4 occurred in 1976 at the 5403 hydrant pumping station. Most of this fuel was flushed to surface drains with water and some soaked into the ground. A fire at the DPDO area in 1976 resulted in spillage of some PCB transformer oil. The soil which received the spilled material was removed and disposed off base.

One interviewee indicated the railroad tank car used for waste storage for several years was suspected to be leaking although this was not confirmed.

DYESS AFB
POL SLUDGE DISPOSAL AREAS



SOURCE: INSTALLATION DOCUMENTS

Pesticide Utilization

A number of pesticides are used by entomology and golf course maintenance personnel at Dyess AFB. A listing of those currently used is included in Appendix D.

Containers are triple rinsed prior to landfill disposal. For the past 15 years this has been the disposal method for pesticide containers. Prior to about 1970 unrinsed pesticide containers were placed in an evaporation/disposal pit (discussed later). All container rinsate is used in preparing dilution water for the pesticide solutions. Water used in rinsing the sprayers is used for dilution water or sprayed at random locations on base.

Fire Protection Training

Two different areas have been used to conduct training exercises for fire department personnel at Dyess AFB (Figure 4.3). The first area was used for a number of years and is located near the old Tye Airfield. The second site, which is currently being used, has been in operation since the late 1960's. Photographs of the current fire protection training area (FPTA) are shown in Appendix F.

Fire Protection Training Area No. 1

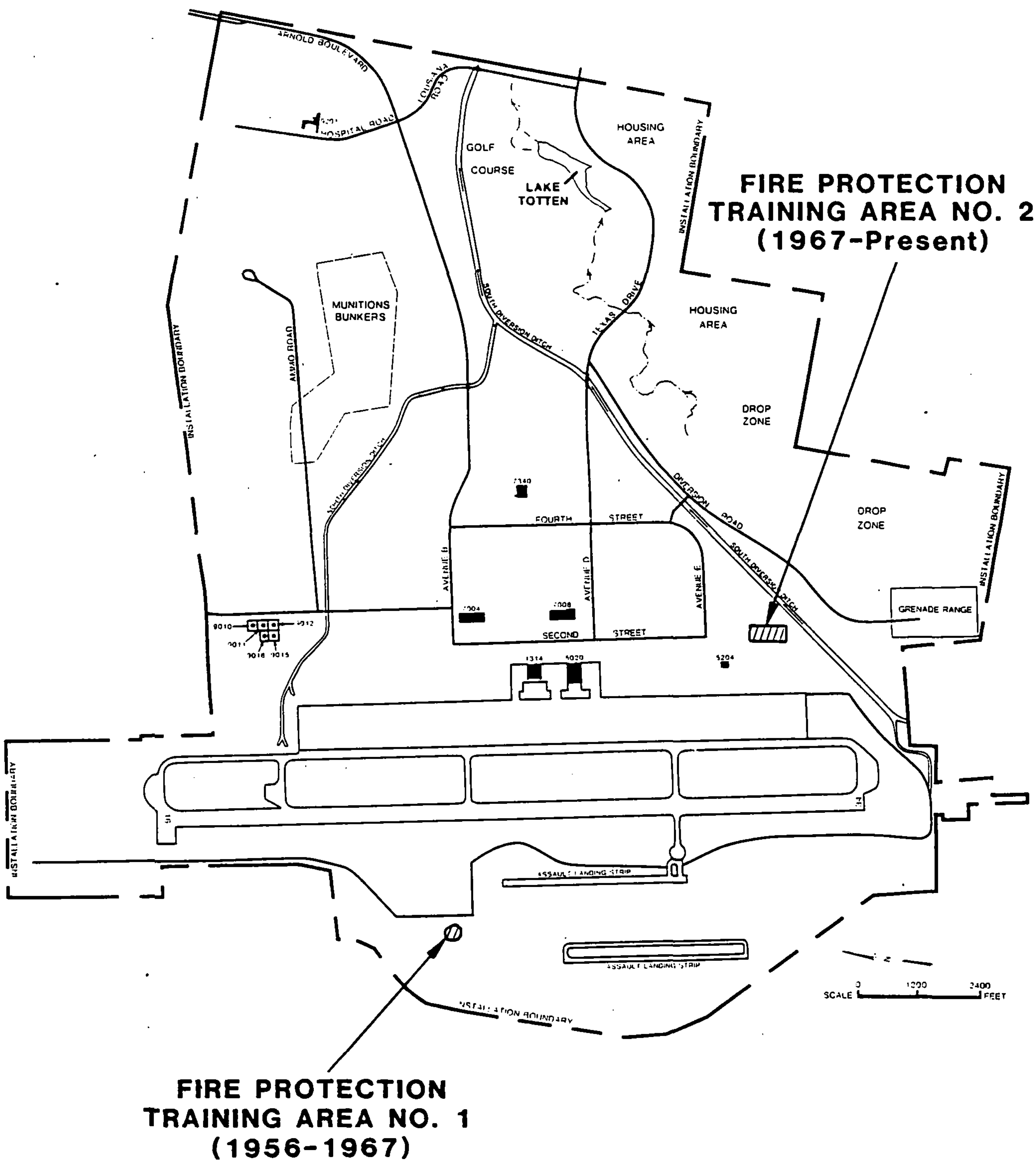
FPTA No. 1 was used from about 1956 until 1967 for training fire protection personnel. Drums of ignitable waste were burned. The drums were taken to the area, punctured, then ignited as the waste leaked onto the ground. Water was not applied to the ground prior to the waste leaking onto the ground. The waste burned included such materials as JP-4, oils, paint thinners and paints. About 500 gallons of waste was typically used per fire and the average frequency of fires was four per month. The extinguishing agents used included protein foam and water.

There is no surface evidence of FPTA No. 1. Demolition of old Tye Airfield structures took place in the area about ten years ago and this probably disturbed the site.

Fire Protection Training Area No. 2

The current FPTA has been used since 1967. The training area consists of a large aircraft mockup and a small pit. JP-4 (clean and contaminated) has been the primary fuel burned at the site but some shop wastes were combusted in the early years of operation. Six storage

DYESS AFB
FIRE PROTECTION TRAINING AREAS



SOURCE: INSTALLATION DOCUMENTS

tanks which have a total capacity of about 2200 gallons supply the training areas with fuel. Underground pipelines transfer the fuel from the tanks to the burning areas.

The fires in the large mockup area use between 100 and 750 gallons of fuel. In the small burning pit about 100 to 150 gallons of fuel are used for each fire. Since the late 1970's there have been about 16 fires per year in the large mockup area and 8 fires per year in the small pit. Prior to the late 1970's, fires occurred more often and the quantities of fuel for each fire was greater. Water has typically been applied to the ground before pouring fuels on the site.

The small fire pit has concrete side walls and bottom. The larger pit is curbed with compacted gravel and soil but does not have any type of concrete containment. Remaining liquids in the large mockup area drain through a gravity line to a small unlined evaporation pit. The evaporation pit (about 10 ft x 10 ft x 3 ft) is located near the large mockup area.

Aqueous film forming foam (AFFF) has been used since 1971 to extinguish fires in the large mockup area. Dry chemicals and halon are used to extinguish fires in the small fire pit. Other extinguishing agents which have been used in the past include protein foam, chlorobromomethane, and carbon dioxide.

INSTALLATION WASTE DISPOSAL METHODS

The facilities at Dyess AFB which have been used for management and disposal of waste are as follows:

- Landfill
- Hardfills
- Evaporation Pit
- Waste Storage Tank (Railroad Tank Car)
- Explosive Ordnance Disposal Area
- Sanitary Sewerage System
- Oil-Water Separators
- Surface Drainage System
- Incinerators

Landfill

Only one landfill site has been used at Dyess AFB. This area, located at the south edge of the base (Figure 4.4), was used to dispose all solid waste from 1955 until 1972. The waste which was placed in the area primarily included refuse and garbage but some shop wastes, construction debris, and brush were also disposed.

Trenches were about 150 to 300 feet long, 16 feet wide and 8 to 10 feet deep. After the excavation of a trench, waste was placed into the trench until filled; once filled it was covered with 4 to 5 feet of soil. Burning took place in the trenches during the early years of use. The existing site has numerous depressions which clearly identify the location of the trenches. The depressions are potential ponding areas for heavy rainfalls.

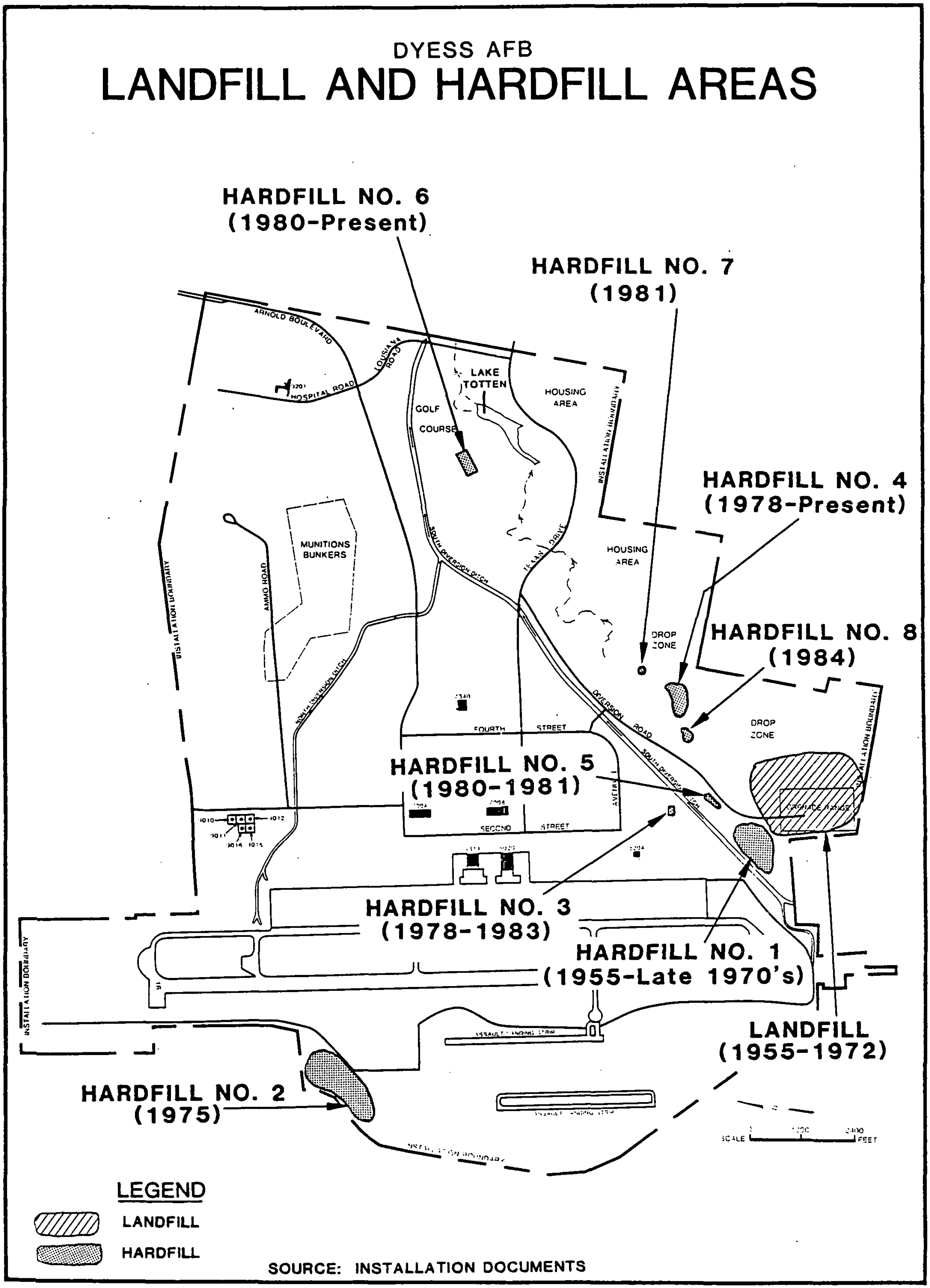
Since 1972, all refuse, garbage and other solid waste have been collected and disposed off base by a contractor. However, construction and demolition debris was disposed of in various hardfill areas on base. Part of the area which was used as a landfill is presently a grenade range. The rest of the landfill area remains undisturbed. Appendix F contains photographs of the landfill.

Hardfills

Several hardfill areas have been used at Dyess AFB to dispose concrete, asphalt, construction/demolition debris, tree limbs and brush. Eight areas have been identified on the installation and these are shown in Figure 4.4. Appendix F contains photographs of some of the hardfill areas.

Hardfill No. 1

A large area west of Diversion Road and east of the south diversion ditch was used for a hardfill during the construction of the base up until the late 1970's. Hardfill No. 1 was used to dispose construction debris such as concrete, asphalt, bricks and lumber. The debris was scattered over the area and pits were also dug to dispose the hardfill material. In the late 1970's, when the area was no longer used to dispose of hardfill material, excavation in the area filled in the pits and leveled the mounds of hardfill material.



ES ENGINEERING-SCIENCE

Hardfill No. 2

During World War II, when the Tye Airfield was an active Army base, numerous buildings stood near where Hardfill No. 2 is now located. Foundations remained in place until approximately 10 years ago. At that time, many of the foundations were covered and concrete rubble from the area was buried in a pit (Hardfill No. 2). The pit measured about 75 feet by 150 feet and was about 7 feet deep. Once the pit was filled, it was covered with soil. There still is evidence of the old runway and also other concrete foundations in the area.

Hardfill No. 3

Hardfill No. 3 is located behind Roads and Grounds, Building 8050. The area was used from 1978 until about 1983 to dispose of concrete and asphalt. A pit 100 feet by 150 feet in size and 3 to 4 feet deep was used to dispose of the concrete and asphalt. There were no reports of any other types of wastes being placed into the area.

Hardfill No. 4

Hardfill No. 4 was started in 1978 and is still in use today. Two pits were originally excavated to dispose of concrete and tree limbs. Once the pits were filled, the surrounding area began to be used as a hardfill area. The hardfill has disposed of tree limbs, brush, concrete, and asphalt. There is also evidence of mattresses, clothing, toys, and other household items scattered throughout the hardfill area. These waste materials reportedly have been taken to the area by persons living on base. Much of the hardfill area has been covered with soil.

Hardfill No. 5

Hardfill No. 5 is located near the buried railroad car on the west side of Diversion Road. This area was used from 1980 to 1981 to dispose of concrete from the base. The concrete was placed on the ground and then spread out over the area. The concrete remains on the ground or partially buried and grass and brush is growing throughout the hardfill site.

Hardfill No. 6

Hardfill No. 6 is located in the base golf course. This disposal area has been in use since 1980. Tree limbs, brush, grass clippings and soil are the only reported wastes which have been placed at the site.

Two trenches approximately 100 feet in length, 16 feet in width and between 4 and 6 feet deep have been used to dispose of the hardfill material.

Hardfill No. 7

In 1981 Hardfill No. 7 was used to dispose of concrete from the base. The concrete was placed in a pile and remains that way today. There were no reports of any other waste being placed in the area.

Hardfill No. 8

Hardfill No. 8 was used in 1984 to dispose of concrete and asphalt from the base. Two pits were excavated approximately 100 feet by 150 feet and 10 feet in depth. Accumulated concrete and asphalt was then placed into the pits and covered with soil. The excavated soil was stockpiled and is currently used as a cover at Hardfill No. 4.

Evaporation Pit

From the late 1950's or possibly early 1960's until the late 1970's an evaporation pit (Figure 4.5) was used to dispose of empty drums, drums containing liquid waste, tree limbs and brush. This area was located in the vicinity of Hardfill No. 1 and measured approximately 150 feet by 300 feet with a depth of 8 to 10 feet. This area reportedly received large quantities of shop liquid waste such as solvents, oils and hydraulic fluids. Numerous shop records indicate that liquid wastes were disposed at the "oil evaporation pit" near the landfill. Several interviewees noted that the wastes did not appear to drain from the area to the nearby South Diversion Ditch.

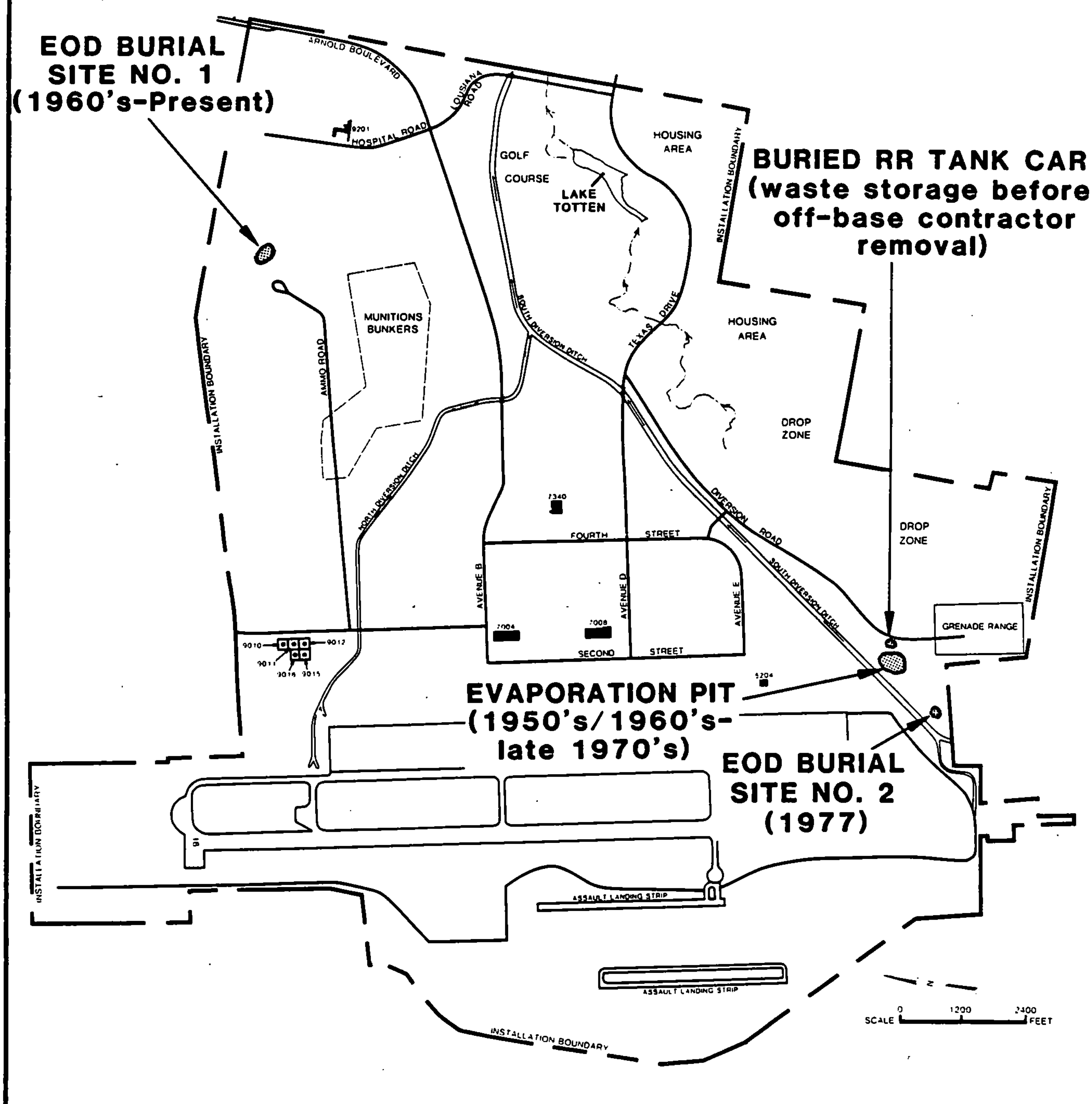
In the late 1970's, soil removed from excavation in the area was used to fill and cover the evaporation pit. This probably took place at the same time as the closing activities for the nearby Hardfill No. 1.

Waste Storage Tank (Railroad Tank Car)

A buried railroad tank car, with a capacity of 10,000 gallons, has been used as a major storage facility for much of the liquid waste generated at Dyess AFB from the early 1960's until 1982. As shown in Figure 4.5, this underground storage tank is located west of Diversion Road and east of the South Diversion Ditch near the present grenade range. Wastes placed into the tank car by shop personnel included such items as carbon removing compound, hydraulic fluids, penetrant, oils,

DYESS AFB

EVAPORATION PIT, EOD BURIAL SITES AND WASTE STORAGE TANK



SOURCE: INSTALLATION DOCUMENTS

thinners, paints, and solvents. The wastes were usually sold to asphalt companies which used the liquids in preparing asphalt.

The tank car was pumped out for a final time in 1982 and the structure remains abandoned in its original location. Sludge accumulated in the tank is believed to remain. No testing was ever performed to assess the structural integrity of the tank.

Explosives Ordnance Disposal Area

The explosives ordnance disposal (EOD) area at Dyess is located near the north edge of the base, northeast of the munitions bunkers (see Figure 4.5). The area consists of a hole in the ground which is used to detonate explosives and a hole used for burning of cartridges, flares, fireworks, small arms and miscellaneous pyrotechnics. Spent casings have been removed from the detonation and burn holes and buried in pits at the site. The pits are approximately 20 feet by 10 feet and about 6 feet deep. The burial pits are covered with a minimum of 18 inches of soil. Several pits have been used in the EOD area in the past.

In about 1977, a pit near Hardfill No. 1 was used as an EOD burial area. The area was used only a few times for the disposal of spent casings.

Sanitary Sewerage System

Wastewater from Dyess AFB has always been treated off base at facilities owned and operated by the City of Abilene. The sanitary sewerage system was constructed along with the base in the early 1950's. The collection system serves all base housing, administrative and shop areas.

Wastewater from the Dyess AFB system has been periodically sampled by the City of Abilene to characterize the discharge. Data has been obtained (1 to 7 times per year) since 1976. A review of the information indicates heavy metals and pH have routinely been within acceptable limits established by the City. However, a few excursions of total suspended solids, biochemical oxygen demand and oil and grease are indicated, suggesting intermittent discharge of some shop wastes have probably occurred.

Oil-Water Separators

There are ten oil-water separators installed at Dyess AFB. Table 4.2 lists the facilities and indicates the effluent discharge point for each. Three units were likely installed in the early 1970's but the others have been constructed within the past four years.

Oil is removed from the separators on an "as required" basis. Waste oils are disposed off base via the DPDO.

Some of the installation documents suggest that other oil-water separators exist on the base at other locations. These other facilities referred to as oil-water separators are either waste oil storage tanks (such as at the BX Service Station and Auto Hobby Shop) or catch basin/-sediment trap-type structures (such as for BX Service Station, Vehicle Maintenance, and Auto Hobby washrack/floor drains; AGE washrack, etc.).

Surface Drainage System

As discussed in Section 3, the surface drainage system at the base consists of storm sewers and open ditches/channels. The surface drainage system has received accidental fuel spills and periodic spills/discharges from the shop areas. Oil-water separators installed in the early 1970's and in the early 1980's have controlled some of the shop discharges. Most of the storm drainage from the shop area enters the North Diversion Ditch (see Figure 3.2).

Installation documents note one incident relative to base surface water quality. The first occurred in 1970 and is referred to as a pollution claim (Amerine vs. Dyess AFB, TX). A local farmer complained that his livestock were suffering adverse health effects due to the pollution of Little Elm Creek by Dyess AFB. An investigation by base personnel concluded that the aircraft washrack was discharging wastewater via a subsurface storm drain and the diversion ditch to Little Elm Creek. Water in the stream then flowed off base to the farmer's property where a portion of it was impounded to provide livestock watering supplies. Analytical data indicated that water discharged from the washrack contained elevated concentrations of surfactants, dissolved solids, phosphate, sulfate, iron, manganese, lead and had a moderately high chemical oxygen demand. The discharge problem was subsequently corrected.

TABLE 4.2
OIL-WATER SEPARATORS
AT DYESS AFB

Facility No.	Area Served	Approximate Year of Installation	Effluent Discharge Point
4116	Fuels Management	1982	Sanitary Sewer
4220	Aircraft Washrack	(1)	Sanitary Sewer
4311	Engine Shop	1984	Sanitary Sewer (2)
4315	Fuel Cell Docks	Early 1970's	Storm Sewer
4316	Fuel Cell Docks	Early 1970's	Storm Sewer
5017	Refurb Hanger	Early 1980's	Storm Sewer
5204	Munitions Equipment Maintenance	1983	Sanitary Sewer
5300	Engine Test Cell	1981	Surface Drainage
5305	Engine Test Cell	Early 1980's	(3)
8007	CE Vehicle Washrack	1981	Sanitary Sewer

(1) Oil-water separator probably installed in 1970's as a result of stream pollution incident (discussed in this section). Date for revision of discharge from storm system to sanitary system unknown.
(2) Revised from storm sewer system in 1985.
(3) After the oil-water separator, discharge is to a septic tank and then an underground tile field.

Source: Installation documents.

Incinerators

Two incinerators are operated on the base. The hospital (Building 9202) operates an incinerator for combustion of pathological waste and Facility 8606 is an incinerator used for burning classified documents and refuse returned on aircraft from overseas locations. Previously an incinerator operated at Building 7318 was used for the classified documents. The ash from the incinerators has been disposed at the on-base landfill until it closed and then at off-base disposal sites.

EVALUATION OF PAST DISPOSAL ACTIVITIES AND FACILITIES

Review of past waste generation and management practices at Dyess AFB has resulted in identification of 25 sites and/or activities which were considered as areas of concern for potential contamination and migration of contaminants.

Sites Eliminated from Further Evaluation

The sites of initial concern were evaluated using the Flow Chart presented in Figure 1.2. Sites not considered to have a potential for contamination were deleted from further evaluation. The sites which have potential for contamination and migration of contaminants were evaluated using the Hazard Assessment Rating Methodology (HARM). Table 4.3 summarizes the results of the flow chart logic for each of the areas of initial concern.

Sixteen of the 25 sites/activities assessed did not warrant further evaluation. The rationale for omitting these sites from HARM evaluation is discussed below.

Hardfill Nos. 1 through 8 have received construction and demolition debris (concrete, asphalt, wood, etc.), tree limbs and brush, and other bulky items. There is no evidence hazardous waste was disposed at these sites. Hardfill No. 1 was immediately adjacent to the evaporation pit and probably was closed about the same time. Some materials from the evaporation pit could have been mixed with hardfill materials during closure operations but this will be considered as a part of the assessment of the evaporation pit.

TABLE 4.3
SUMMARY OF FLOW CHART LOGIC FOR AREAS OF
INITIAL HEALTH, WELFARE AND ENVIRONMENTAL CONCERN
AT DYESS AFB

Site	Potential Hazard to Health, Welfare or Environment	Need for Further IRP Evaluation/ Action	HARM Rating
Landfill	Yes	Yes	Yes
Fire Protection Training Area No. 1	Yes	Yes	Yes
Fire Protection Training Area No. 2	Yes	Yes	Yes
Evaporation Pit	Yes	Yes	Yes
Waste Storage Tank (Railroad Tank Car)	Yes	Yes	Yes
POL Sludge Disposal Area No. 1	Yes	Yes	Yes
POL Sludge Disposal Area No. 2	Yes	Yes	Yes
South Diversion Ditch	Yes	Yes	Yes
North Diversion Ditch	Yes	Yes	Yes
Hardfill No. 1	No	No	No
Hardfill No. 2	No	No	No
Hardfill No. 3	No	No	No
Hardfill No. 4	No	No	No
Hardfill No. 5	No	No	No
Hardfill No. 6	No	No	No
Hardfill No. 7	No	No	No
Hardfill No. 8	No	No	No
EOD Burial Site No. 1	No	No	No
EOD Burial Site No. 2	No	No	No
POL Sludge Disposal Area No. 3	No	No	No
Tanks x 13 Waste Accumulation Areas	No	No	No
Spill and Leak Areas	No	No	No
Pesticide Handling	No	No	No
Wastewater System	No	No	No
Incinerators	No	No	No

Source: Engineering-Science

The explosive ordnance disposal areas have burned or detonated a wide variety but small quantity of munitions and explosives. Site No. 1 has operated for a number of years but site No. 2 functioned only one year. Burning of the solid explosives minimized residual materials at the site. The solid nature of any residuals and the environmental setting minimizes any contamination potential.

POL Sludge Disposal Area No. 3 has only been used a few years and has thus received small quantities of POL tank cleaning sludge compared to the other two sites. Site No. 3 is situated such that the receptors and pathways for potential contamination are minimized compared with other areas. Based on these factors, this site is not considered to have potential for contamination.

There are no records of major spills or leaks at waste accumulation areas. Several waste accumulation areas have also been in operation only a few years. Therefore the accumulation points have been eliminated from further assessment.

Spills and leaks have occurred at several locations on the base. These have either been cleaned up at the site or flushed to the surface drainage system. Both the North and South Diversion Ditches will be evaluated further as the primary recipient of long-term spills and leaks at the base. Specific spill and leak sites will not be evaluated further.

The methods used for handling pesticides on the base do not suggest potential contamination. Containers have routinely been rinsed and properly disposed.

The wastewater system has received periodic discharges of shop wstes as evidenced from city monitoring data. However, no on-going performance problems have been reported by city wastewater treatment personnel.

The incinerators on base have no indication of operations which cause hazardous disposal of wastes.

<u>Sites Evaluated Using HARM</u>

The remaining nine sites identified in Table 4.3 were evaluated using the Hazard Assessment Rating Methodology. The HARM process takes into account characteristics of potential receptors, waste characteristics, pathways for migration, and specific characteristics of the site related to waste management practices. Results of the HARM analysis for the sites are summarized in Table 4.4. The POL Sludge Disposal Area No. 2 is situated on top of or adjacent to the landfill and these sites have been combined for the HARM rating. Similarly, the waste storage tank is located adjacent to the evaporation pit and has been combined. Thus, only seven HARM ratings appear for the nine sites in Table 4.4.

The procedures used in the HARM system are outlined in Appendix G and the specific rating forms for the seven sites at Dyess AFB are presented in Appendix H. The HARM system is designed to indicate the relative need for follow-on action.

TABLE 4.4
SUMMARY OF HARM SCORES FOR
POTENTIAL CONTAMINATION SITES
AT DYESS AFB

Rank	Site	Receptor Subscore	Waste Charac- teristics Subscore	Pathways Subscore	Waste Management Factor	HARM Score
1	Evaporation Pit/Waste Storage Tank	52	90	43	1.0	62
2	North Diversion Ditch	53	56	52	1.0	54
3	Fire Protection Training Area No. 2	51	64	50	0.95	52
4	Fire Protection Training Area No. 1	29	64	56	1.0	50
5	Landfill/POL Sludge Disposal Area No. 2	54	48	43	1.0	48
6	South Diversion Ditch	53	40	49	1.0	47
7	POL Sludge Disposal Area No. 1	45	36	56	1.0	46

NOTE: HARM Score = [(Receptors + Waste Characteristics + Pathways) x 1/3] x Waste Management Factor

Source: Engineering-Science

SECTION 5
CONCLUSIONS

The goal of the IRP Phase I study is to identify sites where there is potential for environmental contamination resulting from past waste disposal practices and to assess the probability of contamination migration from these sites. The conclusions given below are best estimates based on field inspections; review of records and files; review of the environmental setting; interviews with base personnel, past employees and local, state and federal government employees; and assessments using the HARM system. Table 5.1 contains a list of the potential contamination sources identified at Dyess AFB and a summary of the HARM scores for those sites.

EVAPORATION PIT/WASTE STORAGE TANK

The evaporation pit/waste storage tank site has sufficient potential to create environmental contamination and follow-on investigation is warranted. The evaporation pit received significant quantities of waste oils, solvents, hydraulic fluids, etc., for numerous years. The evaporation pit was unlined and thus had the potential to leach wastes into the ground. The underground waste storage tank also received similar waste materials. It is uncertain whether the storage tank leaked. The waste characteristics subscore predominantly influenced the total HARM score of 62.

NORTH DIVERSION DITCH

The north diversion ditch, particularly near the flightline area, has sufficient potential to create environmental contamination and follow-on investigation is warranted. Most of the storm drainage from the shop area enters this drainage channel. The aircraft washrack and other uncontrolled shop discharges went to the ditch in the early years of base operations. The north diversion ditch has flow periodically.

TABLE 5.1
SITES EVALUATED USING THE
HAZARD ASSESSMENT RATING METHODOLOGY
AT DYESS AFB

Rank	Site	Operation Period	HARM Score[1]
1	Evaporation Pit/Waste Storage Tank	1950's/1960's - late 1970's	62
2	North Diversion Ditch	1955 - Present	54
3	Fire Protection Training Area No. 2	1967 - Present	52
4	Fire Protection Training Area No. 1	1956 - 1967	50
5	Landfill/POL Sludge Disposal Area No. 2	1955 - 1972[2] 1967 - 1978[3]	48
6	South Diversion Ditch	1955 - Present	47
7	POL Sludge Disposal Area No. 1	1958 - 1967	46

(1) This ranking was performed according to the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.
(2) Landfill
(3) POL Sludge Disposal Area

This intermittent flow condition may cause the channel to function as a leaching area when shop wastes are discharged. The waste characteristics subscore contributed to the total HARM score of 54.

FIRE PROTECTION TRAINING AREA NO. 2

Fire Protection Training Area No. 2, operated for a number of years, has sufficient potential to create environmental contamination and follow-on investigation is warranted. Materials burned at the site have primarily been clean and contaminated JP-4 fuels but some oils and shop wastes have also been burned. The waste characteristics subscore influenced the total HARM score of 52.

FIRE PROTECTION TRAINING AREA NO. 1

Fire Protection Training Area No. 1 has sufficient potential to create environmental contamination and follow-on investigation is warranted. This site burned a variety of combustible shop wastes during the early years of base operations. There is no surficial evidence of this fire protection training area. It is believed Hardfill No. 2 disposal operations may have disturbed the soil at the site. The total HARM score of 50 is influenced by the waste characteristics subscores.

LANDFILL/POL SLUDGE DISPOSAL AREA NO. 2

The landfill and POL sludge disposal area has sufficient potential to create environmental contamination and follow-on investigation is warranted. Relatively moderate quantities of POL tank cleaning sludge, paint sludge and other shop wastes were disposed at the site. The receptor subscore contributed to the total HARM score of 48.

SOUTH DIVERSION DITCH

The south diversion ditch is concluded to have minimal potential to create environmental contamination. This drainage channel has received runoff from the engine test cells but most of the shop area drains to the north diversion ditch. The drainage area contributing to the south diversion ditch is significantly larger than the north channel and thus has more opportunity to minimize the impact of any surface runoff contaminants. As discussed later in Section 6, the south diversion ditch will be considered indirectly as a part of further investigations at the leaching pit and landfill. The total HARM score for the south drainage channel is 47, which is primarily influenced by the receptors subscore.

POL SLUDGE DISPOSAL AREA NO. 1

The POL sludge disposal area (No. 1) located adjacent to the bulk storage tanks is concluded to have minimal potential to create environmental contamination. A small quantity of tank cleaning sludge was weathered in the area for about a ten year period. The low waste characteristics subscore contributed to the total HARM score of 46. The runoff impact of the sludge weathering site will indirectly be assessed as a part of the north diversion ditch evaluation (discussed in Section 6).

SECTION 6

RECOMMENDATIONS

Seven sites were identified at Dyess AFB as having the potential for environmental contamination. These sites have been evaluated and rated using the HARM system which assesses their relative potential for contamination and provides the basis for determining the need for additional Phase II IRP investigations. Five of the seven sites have sufficient potential to create environmental contamination and warrant Phase II investigations.

RECOMMENDED PHASE II MONITORING

The subsequent recommendations are made to further assess the potential for environmental contamination from waste disposal areas at Dyess AFB. The recommended actions are hydrogeological surveys and sampling and monitoring programs to determine if contamination does exist at the site. If contamination is identified in this first-step investigation, the Phase II sampling program will probably need to be expanded to define the extent and type of contamination.

The hydrogeologic conditions present at each disposal site are entirely site-specific due to variations in geology, topography, land use modifications, etc. These conditions or man-made changes in the local environmental setting must be clearly understood in order to design an effective ground-water quality monitoring system. At present, these site-specific conditions at Dyess AFB disposal areas are unknown. Soil test borings and temporary observation wells may need to be employed to obtain the required information. A systematic, more efficient and cost-effective approach would be to utilize geophysical techniques to obtain preliminary local subsurface information. Electrical resistivity (ER) and electromagnetic conductivity (EMC) are geophysical instruments that employ indirect measurement technologies to collect data describing subsurface material electrical properties. They respond to changes or contrasts in either the horizontal or vertical planes which may be correlated to direct sampling methods, such as test borings. Both methods may be utilized in shallow situations (less than thirty feet deep) if local geology permits, to determine stratigraphic changes, depth to ground water, aquifer thickness and contaminated zones if sufficient contrast exists. ER may be employed in more complicated terrains or in situations where deep contamination is suspected. Wells may then be installed systematically, in zones selected by the geophysical techniques. This approach to monitoring program design significantly reduces both costs and schedules. The use of geophysical techniques at waste disposal facilities has been well documented in the technical literature. A USEPA guidance manual describes the capabilities and limitations of electrical resistivity at waste disposal facilities and is applicable to the probable conditions that may be encountered at Dyess AFB (USEPA, 1978). Other geophysical methodologies can be utilized for specialized purposes. For example, the magnetometer may be utilized to locate either buried objects or disturbed zones (backfilled trenches or pits) in shallow and deep settings.

Ground-water quality monitoring systems must be designed for the existing site-specific conditions. Guidelines for well system design have been published in several USEPA reports. For large areas/landfills, or for areas with multiple ground-water flow directions, it is recommended that more than the usual four wells (one upgradient and three downgradient, from RCRA, Subpart F, Section 265.91, "Ground-Water Monitoring System") be provided. Where multiple flow directions may exist beneath a site, geophysical methods should be utilized to guide well placement, both the physical location and the screened interval. In situations where the site is physically large or has an unusual geometry and therefore has a long downgradient dimension (the site border, which when sketched on a topographic map, appears to be drawn at a right angle to the principal direction of ground-water flow), the general rule is to install one monitoring well for each 250 feet of downgradient frontage (USEPA, 1980). This well spacing is considered to be a maximum allowable interval between wells, assuming that local hydrogeologic conditions are reasonably uniform. Wells must be installed at closer intervals if the site subsurface conditions are determined to be complex.

The recommended Phase II monitoring program for the four sites at Dyess AFB is summarized in Table 6.1 and discussed below for each site.

Evaporation Pit/Waste Storage Tank and Landfill/POL Sludge Disposal Area No. 2

The evaporation pit and landfill/sludge disposal areas are very close together. Phase II monitoring at these sites is recommended to be combined since the hydrogeological conditions are likely to be closely linked.

The initial steps recommended include obtaining one test boring and then conducting an EMC survey at the site. A magnetometer survey is then recommended. The results of these initial surveys can be correlated to provide a basis for more clearly defining the subsurface conditions. A site specific hydrogeological study should be performed to fully characterize the ground water flow direction and other factors. These data will then be utilized to strategically locate the two upgradient wells and 12 to 14 downgradient wells. Based upon the anticipated site hydrogeology, one upgradient well would be located by the installation boundary near the evaporation pit and the other in the southwest boundary corner adjacent to the landfill. The downgradient wells would be located along the eastern and northern perimeter of the evaporation pit and landfill site.

The monitoring wells would be sampled and analyzed for the parameters in Table 6.2. In addition it is proposed to obtain sediment samples at about four locations in the South Diversion Ditch and conduct the analyses in Table 6.2. This monitoring program will serve as a screening to determine potential contamination from these disposal sites. If this initial screening provides positive results, more extensive tests and possibly additional wells may be necessary in Phase II to fully characterize the extent and type of contamination.

North Diversion Ditch

Sediment samples collected at about six locations from the North Diversion Ditch are recommended. Four samples should be obtained in the vicinity of the flightline discharges with the remaining two spaced at wider intervals to the South Diversion Ditch confluence. The objective of this sampling and analysis is to characterize the potential impact from long-term discharges and spills to the drainage system. If shallow

TABLE 6.1
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP
AT DYESS AFB

Site (Rating Score)	Recommended Monitoring Program
Evaporation Pit/Waste Storage Tank (62) and Landfill/POL Sludge Disposal Area No 2 (48)	Obtain one test boring at the site. Perform a geophysical survey using electromagnetic conductivity techniques to define the limits of the evaporation pit. Conduct a magnetometer survey of the evaporation pit site to identify areas where drums are buried. Perform a site specific hydrogeological study of the evaporation pit-landfill area. Locate and install 2 upgradient (background) wells and 12 to 14 wells downgradient of the evaporation pit-landfill area. Construct the wells with Schedule 40 PVC and screen them at least 10 ft. into the upper aquifer. Allow the screen to extend above the water table to collect any floating materials. Obtain four downstream samples (at surface and 4.0 ft. deep) in the South Diversion Ditch at approximately 1,000 ft intervals starting from the evaporation pit area. Fill and compact sample holes with clay. Sample and analyze the ground water and sediment samples for the parameters in Table 6.2.

TABLE 6.1
(Continued)
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP
AT DYESS AFB

Site (Rating Score)	Recommended Monitoring Program
North Diversion Ditch (54)	Obtain about six sediment samples at the surface and 4.0 ft. deep from the North Diversion Ditch. Take four samples at approximately 1,000 ft. intervals near the flightline discharges and the remaining two spaced evenly to the confluence with the South Diversion Ditch. Fill and compact the sample holes with clay. Analyze the sediment samples for the parameters listed in Table 6.2.
Fire Protection Training Area No. 2 (52)	Obtain one test boring about 30 ft. deep at the site. Conduct an electri cal resistivity survey of the site. Utilize the geophysics data and test boring data to confirm the continuity of the site geology and to assist in finalizing monitoring well locations. Install one upgradient and three downgradient monitoring wells. Construct the wells with Schedule 40 PVC and screen them at least 10 ft. into the upper aquifer. Allow the screen to extend above the water table to collect any floating materials. Sample and analyze the ground water for the parameters in Table 6.2.
Fire Protection Training Area No. 1 (50)	Obtain four soil borings (one control) 10 ft. deep or to the water table if it is less than 10 ft. Analyze the soil every 2 ft. for the parameters listed in Table 6.2.

Source: Engineering-Science

TABLE 6.2
RECOMMENDED LIST OF ANALYTICAL PARAMETERS FOR PHASE II IRP
AT DYESS AFB

Evaporation Pit/Waste Storage Tank
and
Landfill/POL Sludge Disposal Area No. 2

Ground Water	Sediment
pH	Oil and Grease
Oil and Grease	Volatile Hydrocarbons
Total Dissolved Solids	EP Toxicity (Metals Only)
Total Organic Carbon	
Total Organic Halogens	
Lead	
Phenols	
PCB	

Fire Protection Training Area No. 2 (Ground Water)

pH
Oil and Grease
Total Dissolved Solids
Total Organic Carbon
Total Organic Halogens
Lead
Phenols

North Diversion Ditch (Sediment) and Fire Protection
Training Area No. 1 (Soil)

Oil and Grease
Volatile Hydrocarbons
EP Toxicity (Metals Only)

Source: Engineering-Science

sediment contamination is indicated, the Phase II program should be expanded to include deeper drainage channel soil borings and/or monitoring wells along the channel.

Fire Protection Training Area No. 2

At FPTA No. 2 one test boring is recommended at the site in the vicinity of the large burning area and evaporation pit. Soil characteristics obtained from this boring would be correlated with ER survey data to fully characterize the subsurface geological conditions. This site information will enable effective siting of one upgradient and three downgradient monitoring wells. Based upon the current understanding of site hydrogeology it is expected that the background well would be positioned between the FPTA site and the aircraft apron while the downgradient wells would be located generally east-southeast of the burning-evaporation pit area.

The parameters to be analyzed for the ground water samples (Table 6.2) will serve as a screening to determine if contamination exists at the site. More extensive tests may be required if positive results are obtained in the initial sampling.

Fire Protection Training Area No. 1

At FPTA No. 1 three soil borings in the area used for burning and one control boring away from the area are recommended. The soil borings should be taken to a depth of 10 feet or to the water table if it is less than 10 feet. Soil samples should be collected and analyzed every two feet for the parameters listed in Table 6.2. If soil sampling verifies contamination, monitoring wells and/or more soil sampling may be necessary to assess the extent of migration.

TABLE OF CONTENTS
APPENDICES

TABLE OF CONTENTS
APPENDICES
(Continued)

APPENDIX A

BIOGRAPHICAL DATA

Biographical Data

ROBERT L. THOEM
Civil/Environmental Engineer

Personal Information

Date of Birth: August 26, 1940

Education

B.S. Civil Engineering, 1962, Iowa State University, Ames, IA
M.S. Sanitary Engineering, 1967, Rutgers University, New Brunswick, NJ

Professional Affiliations

Registered Professional Engineer in six states
American Academy of Environmental Engineering (Diplomate)
American Society of Civil Engineers (Fellow)
National Society of Professional Engineers (Member)
Water Pollution Control Federation (Member)

Honorary Affiliations

Who's Who in Engineering
Who's Who in the Midwest
USPHS Traineeship

Experience Record

1962-1965 U.S. Public Health Service, New York, NY. Staff Engineer, Construction Grants Section (1962-1964). Technical and administrative management of grants for municipal wastewater facilities.

Water Resources Section Chief (1964-1965). Supervised preparation of regional water supply and pollution control reports.

1966-1983 Stanley Consultants, Muscatine, IA and Atlanta, GA. Project Manager and Project Engineer (1966-1973). Responsible for managing studies and preparing reports for a variety of industrial and governmental environmental projects.

Environmental Engineering Department Head (1973-1976). Supervised staff involved in auditing environmental practices, conducting studies and preparing reports concerning water and wastewater systems, solid waste and resource recovery and water resources projects (industrial and governmental).

Resource Management Department Head (1976-1982). Responsible for multidiscipline staff engaged in planning and design of water and wastewater systems, solid waste and resource recovery, water resources, bridge, site development and recreational projects (industrial, domestic and foreign governments).

Associate Chief Environmental Engineer (1980-1983). Corporate-wide quality assurance responsibilities on environmental engineering planning projects.

Operations Group Head and Branch Office Manager (1982-1983). Directed multidiscipline staff responsible for planning and design of steam generation, utilities, bridge, water and wastewater systems, solid waste and resource recovery, water resources, site development and recreational projects (industrial, domestic and foreign governments). Administered branch office support activities.

Project Manager/Engineer for over 25 industrial projects, 25 city and county projects ranging in present study area population from 1,400 to 1,700,000, 10 regional (multi-county) planning or operating agency projects, five state agency projects, 10 projects for federal agencies, and several projects for Middle East governments.

1983-Date Engineering-Science. Senior Project Manager. Responsible for managing a variety of environmental projects. Conducted hazardous waste investigations at seven U.S. Air Force installations to identify the potential migration of contaminants resulting from past disposal practices under the Phase I Installation Restoration Program. Evaluated solid waste collection, disposal and potential for resource recovery at a U. S. Army post.

Publications and Presentations

Thirteen presentations and/or papers in technical publications dealing with solid waste, sludge, water, wastewater and project cost evaluations.

Biographical Data

JOHN R. ABSALON
Hydrogeologist

Personal Information

Date of Birth: 12 May 1946

Education

B.S. in Geology, 1973, Upsala College, East Orange, New Jersey

Professional Affiliations

Certified Professional Geologist (Indiana No. 46) (Virginia No. 241)
Association of Engineering Geologists
Geological Society of America
National Water Well Association

Experience Record

1973-1974 Soil Testing Incorporated-Drilling Contractors, Seymour, Connecticut. Geologist. Responsible for the planning and supervision of subsurface investigations supporting geotechnical, ground-water contamination, and mineral exploitation studies in the New England area. Also managed the office staff, drillers, and the maintenance shop.

1974-1975 William F. Loftus and Associates, Englewood Cliffs, New Jersey. Engineering Geologist. Responsible for planning and management of geotechnical investigations in the northeastern U.S. and Illinois. Other duties included formal report preparation.

1975-1978 U.S. Army Environmental Hygiene Agency, Fort McPherson, Georgia. Geologist. Responsible for performance of solid waste disposal facility siting studies, non-complying waste disposal site assessments, and ground-water monitoring programs at military installations in the southeastern U.S., Texas, and Oklahoma. Also responsible for operation and management of the soil mechanics laboratory.

1978-1980 Law Engineering Testing Company, Atlanta, Georgia. Engineering Geologist/Hydrogeologist. Responsible for the project supervision of waste management, water quality assessment, geotechnical, and hydrogeologic studies at commercial, industrial, and government facilities. General experience included planning and management of several ground-water monitoring programs, John R. Absalon (Continued)

development of remedial action programs, and formulation of waste disposal facility liner system design recommendations. Performed detailed ground-water quality investigations at an Air Force installation in Georgia, a paper mill in southwestern Georgia, and industrial facilities in Tennessee.

1980-Date Engineering-Science. Hydrogeologist. Responsible for supervising efforts in waste management, solid waste disposal, ground-water contamination assessment, leachate generation, and geotechnical and hydrogeologic investigations for clients in the industrial and governmental sectors. Performed geologic investigations at twelve Air Force bases and otherindustrial sites to evaluate the potential for migration of hazardous materials from past waste disposal practices. Conducted RCRA ground-water monitoring studies for industrial clients and evaluated remedial action alternatives for a county landfill in Florida. Conducted quality management, hydrogeologic and ground-water quality programs for the pulp and paper industry at several mills located in the Southeast United States.

Publications and Presentations

Eleven presentations and/or papers in technical publications or conferences dealing with geology, ground water, and waste disposal/-ground water interaction.

Biographical Data

THOMAS R. HARPER
Environmental Scientist

Personal Information

Date of Birth: 25 March 1959

Education

B.S. in Chemistry, 1983, Ohio State University, Columbus, OH
B.S. in Microbiology, 1983, Ohio State University, Columbus, OH

Professional Affiliations

American Chemical Society

Experience Record

1983-Date Engineering-Science, Inc., Atlanta, Georgia.

Analytical Chemist (1983-1984). Laboratory work involved analyzing samples from industrial clients. Analysis for priority pollutants, heavy metals, and organic compounds on samples including soils, sludges, water, and wastewater. Experience with instrumentation includes TOC, gas and liquid chromatography, atomic absorption, infra-red and nuclear magnetic resonance spectroscopy.

Bench scale wastewater treatability testing includes studies of PCB and DEHP removal for a capacitor manufacturer, organics removal for a pharmaceutical company, and solids removal for a food processing plant. Bioassay study was performed for a specialty chemical company. Geophysical surveys using electrical resistivity for a pesticide manufacturer and a lead reclamation facility.

Environmental Scientist (1984-Date). Involved in the development of environmental studies, inventories, and evaluations for municipal, industrial, and federal government projects.

Participated in environmental audits of past waste disposal practices including the disposal of hazardous wastes. These evaluations were conducted at two Air Force Bases. This involved records search, data evaluation, shop inspections, disposal site investigations and ecological analysis for these installations.

Thomas R. Harper (Continued)

A key member in the preparation of a Part B for an adhesives manufacturing facility operated by General Electric. Project Manager for a hazardous waste Closure Plan and Part A revision under RCRA for General Motors. Prepared a satellite accumulation plan required under RCRA for an adhesives manufacturer. The plan outlined the RCRA requirements for hazardous waste storage of less than 90 days.

APPENDIX B

LIST OF INTERVIEWEES AND OUTSIDE AGENCY CONTACTS

TABLE B.1
LIST OF INTERVIEWEES

Most Recent Position	Years of Service at Dyess
1. NCOIC, Explosives Ordnance Disposal, 96 MMS	2
2. NCOIC, Entomology, 96 CES	1
3. Grounds Equipment Operator, 96 CES	17
4. Pest Management Technician, 96 CES	12
5. Chief of Fire Protection, 96 CES	16
6. Chief of Tech Services, Fire Protection, 96 CES	28
7. Assistant Fire Department Superintendent, 96 CES	8
8. Chief of DPDO	24
9. Base Architect, 96 CES	25
10. Deputy Chief of Operations, 96 CES	29
11. Deputy Base Civil Engineer, 96 CES	12
12. Fuels Maintenance Mechanic, 96 SUPS	11
13. Chief of Engineering Branch, 96 CES	19
14. Real Property Officer (Retired), 96 CES	23
15. Electrical Engineer (Retired), 96 CES	23
16. Base Historian, 96 BMW	1
17. Grounds Equipment Operator, 96 CES	30
18. Chief of Real Property, 96 CES	3
19. Tractor Foreman/Head Greenskeeper, Golf Course, 96 CES	3
20. Foreman, Water Treatment Plant, 96 CES	30
21. Grounds Superintendent, Pavement and Grounds, 96 CES	15
22. NCOIC, Corrosion Control, 463 FMS	4
23. Assistant NCOIC, Corrosion Control, 96 FMS	4
24. Lab Chief, PMEL-TMDE, 96 AMS	3
25. Technician, Fire Control, 96 AMS	4
26. Branch Chief, Offensive Avionic Systems, 96 AMS	2
27. NCOIC, Defense Avionics, 96 AMS	4
28. Defense Avionics Supervisor, 96 AMS	3
29. NCOIC, Auto Flight Control, 96 AMS	2
30. Assistant NCOIC, Engine Test Cell, 96 FMS	5
31. NCOIC, Fuel Systems, 96 FMS	3
32. Assistant NCOIC, Electrical Systems, 96 FMS	2
33. NCOIC, NDI, 96 FMS	11
34. Oil Analyst, NDI, 96 FMS	30
35. Assistant NCOIC, Structural Repair, 96 FMS	1
36. Assistant NCOIC, Pneudraulics, 96 FMS	1
37. Technician, Environmental Systems, 96 FMS	2
38. Foreman, Battery, 96 FMS	1
39. NCOIC, Jet Engine, 96 FMS	4
40. Assistant Branch Chief, AGE, 96 FMS	4

TABLE B.1
LIST OF INTERVIEWEES
(Continued)

Most Recent Position	Years of Service at Dyess
41. Assistant NCOIC, Wheel and Tire, 463 FMS	3
42. Branch Chief, Support Branch, 96 FMS	2
43. Assistant NCOIC, Repair/Reclamation, 463 FMS	4
44. NCOIC, Equipment Maintenance, 96 MMS	4
45. NCOIC, Weapons Loading, 96 MMS	8
46. NCOIC, Conventional Munitions, 96 MMS	4
47. NCOIC, Support Section, 96 MMS	5
48. Former NCOIC, Nonpowered AGE, 96 OMS	3
49. Superintendent, Vehicle Maintenance, 96 TRANS	2
50. Tire Mechanic, Vehicle Maintenance, 96 TRANS	20
51. Audiovisual Manager, Photo Lab, 96 CSG	4
52. Manager, Auto Hobby, 96 CSG	21
53. Power Support Systems Mechanic, Power Production, 96 CES	5
54. Pavement Specialist, Pavement and Grounds, 96 CES	20
55. Assistant NCOIC, Heavy Equip, Pavement & Grounds, 96 CES	1
56. Acting NCOIC, Power Production, 96 CES	2
57. NCOIC, Refrigeration, 96 CES	2
58. Foreman, Refrigeration, 96 CES	23
59. Assistant NCOIC, Exterior Electric, 96 CES	4
60. Foreman, Protective Coating, 96 CES	17
61. Metal Worker, Metal Working, 96 CES	9
62. Contract Inspector, 96 CES	6
63. Design Civil Engineer, 96 CES	4
64. Contract Manager, 96 CES	4
65. Mechanical Superintendent, Heating, 96 CES	8
66. Assistant Head Greenskeeper, Golf Course, 96 CES	4
67. NCOIC, Dental Records, USAF Hosp	3
68. NCOIC, Dental Supply, USAF Hosp	7
69. Assistant NCOIC, Radiology, USAF Hosp	4
70. Vehicle Management Officer, 1st MAPS	3
71. Hazardous Waste Monitor, Refurb, 463 FMS	4
72. Technician, Refurb, 463 FMS	2
73. Equipment Custodian, Propulsion, 463 FMS	4
74. NCOIC, Engine Test, 463 FMS	3
75. NCOIC, Pneudraulics, 463 FMS	12
76. Supervisor, Fuel Systems, 463 FMS	2
77. NCOIC, Environmental Systems, 463 FMS	2
78. Chief, Fabrication Branch, 463 FMS	6
79. NCOIC, Aircraft Washrack, 463 OMS	13
80. Assistant NCOIC, Nonpowered AGE, 463 OMS	9
81. Assistant Manager, BX Service Station	3
82. NCOIC, Det 1, 47 FTW (ACE)	2

TABLE B.1
LIST OF INTERVIEWEES
(Continued)

Most Recent Position	Years of Service at Dyess
83. NCOIC, Radio Maintenance, 1993 ISS	3
84. NCOIC, Navaids and Weather Maintenance, 1993 ISS	7
85. Environmental Coordinator, 96 CES	2
86. Bioenvironmental Engineer, USAF Hosp	1
87. Technician, Nuclear Maintenance, 96 MMS	2
88. Branch Chief, Munitions Services, 96 MMS	6
89. Branch Chief, Munitions Services, 96 MMS	4
90. Chief, Quality Control & Inspection, Fuels Mgmt., 96 SUPS	4
91. Project Manager, Transient Aircraft, 96 OMS	3
92. Engine Manager, Propulsion Shop, 96 FMS	29
93. Plant Management, USAF Hosp	1

TABLE B.2
OUTSIDE AGENCY CONTACTS

Ernest T. Baker, Jr., Subdistrict Chief
U.S. Geological Survey - Water Resources Division
Federal Building
300 East 8th Street
Austin, Texas 78701
512/397-5578

John Burkes, Project Engineer
Hector Mendieta, Director, Permits Division
Bureau of Solid Waste Management
Texas Department of Health
1100 West 49th Street
Austin, Texas 78756
512/458-7271

Henry Day, Assistant Supervisor
Texas Department of Water Resources
224 West Beauregard Street, Suite 102
San Angelo, Texas 76903
915/655-9479

Stanley Thompson, Regional Engineer
Jim Soper, Sanitarian
Texas Department of Health
Commerce Plaza Office Building
1209 South Willis
Abilene, Texas 79605
915/695-7170

Dwayne Hargesheimer, Director
Abilene Water and Sewer Utilities Department
555 Walnut Street
Abilene, Texas 79604
915/676-6416

Mr. William Lewis
Modern Military Field Branch
Washington National Record Center
4025 Suitland Road
Suitland, MD
301/763-1710

TABLE B.2 (Continued)
OUTSIDE AGENCY CONTACTS

Mr. J. Dwyer Cartographic and Architectural Branch National Archives 841 S. Pickett Street Alexandria, VA 22304 703/756-6700	Mr. E. Reese Modern Military Branch National Archives 8th and Pennsylvania Avenue Washington, DC 202/523-3340
Sgt. Jernigan Office of Air Force History Bolling AFB Washington, DC 202/767-5090	

APPENDIX C

TENANT ORGANIZATIONS AND MISSIONS

APPENDIX C
TENANT ORGANIZATIONS AND MISSIONS

Following is a listing of tenant organizations at Dyess AFB and a description of the mission for several of the units:

463rd Tactical Airlift Wing (MAC)
The mission of the 463rd Tactical Airlift Wing is to provide assigned airlift of troops, cargo, military equipment, passengers, and mail. It also participates in operations involving the airland or airdrop of troops, equipment and supplies.

1993rd Information Systems Squadron
The 1993rd Information Systems Squadron provides communications support for the 96th Bombardment Wing (SAC) and the 463rd Tactical Airlift Wing (MAC), and provides air traffic control, navigational aid services, and ground communications for all units at the base.

Detachment 16, 9th Weather Squadron
Detachment 16 of the 9th Weather Squadron provides weather observations and briefings to all Dyess AFB flying units.

417th Field Training Detachment (ATC)
This ATC unit provides Aircraft Specialist training for the 96th Bombardment Wing and the 463rd Tactical Airlift Wing.

Detachment 1, 47th FTW ACE Operations (ATC)
Detachment 1 conducts the Accelerated Co-Pilot Enrichment (ACE) Program at Dyess. A few T-37 aircraft are operated at Dyess for this program.

Federal Aviation Agency (FAA)
The FAA provides continuous radar air traffic control services in and out of the base. This tenant is responsible for operating the transmitter and receiver annexes at Dyess.

Defense Logistics Agency, Defense Property Disposal Office (DPDO)
The DPDO receives and disposes of excess property and other authorized turn-in materials from service generated activities.

3904th Management Engineering Squadron (SACMET)
The 3904th SACMET assists all SAC units and tenant units with manpower problems and related activities.

1600th Management Engineering Squadron (MACMET)
The 1600th MACMET assists all MAC units within the 463rd Wing at Dyess AFB with manpower problems and related activities.

Detachment 1110, Air Force Office of Special Investigation (AFOSI)
Detachment 1110 of the AFOSI provides criminal counter intelligence, internal security and special investigation services for Dyess AFB.

Air Force Audit Agency
The Air Force Audit Agency provides independent review and appraisal of the effectiveness and efficiency with which Air Force managerial responsibility is carried out.

AFROTC Field Training Detachment
The AFROTC detachment conducts Field Training Programs for Air Force Reserve Office Training Corps cadets.

OTHER DYESS TENANT ORGANIZATIONS
Area Defense Counsel
Army and Air Force Exchange Service
Air Force Commissary Service
U. S. Post Office

APPENDIX D

SUPPLEMENTAL BASE FINDINGS INFORMATION

TABLE D.1
LIQUID FUEL AND OTHER PRODUCT TANKS
DYESS AFB

Facility No.	No. Tanks	Total Capacity (gallons)	Above (A) or Below (B) Ground	Active (A) or Inactive (IA)	Material Stored
Aviation Tanks					
4401	6	300,000	B	IA	JP-4
	1	25,000	B	IA	JP-4
4402	6	300,000	B	IA	JP-4
	1	25,000	B	IA	JP-4
4403	6	300,000	B	IA	JP-4
	1	25,000	B	IA	JP-4
4404	6	300,000	B	IA	JP-4
	1	25,000	B	IA	JP-4
5300	2	2,000	A[(2)]	A	JP-4
5305	1	2,500	A[(2)]	A	JP-4
5401	6	300,000	B	A	JP-4
5402	6	300,000	B	A	JP-4
5403	6	300,000	B	A	JP-4
5404	6	300,000	B	A	JP-4
5405	4	200,000	B	A	JP-4
	1	50,000	B	IA	JP-4
9010	1	840,000	A	A	JP-4
9011	1	840,000	A	A	JP-4
9012	1	840,000	A	A	JP-4
9015	1	840,000	A	A	JP-4
9016	1	525,000	A	A	JP-4
Base Support Tanks					
0000	1	3,000	B	A	Diesel Fuel
1001	1	1,000	B	A	Fuel Oil

TABLE D.1 (Continued)
LIQUID FUEL AND OTHER PRODUCT TANKS
DYESS AFB

Facility No.	No. Tanks	Total Capacity (gallons)	Above (A) or Below (B) Ground	Active (A) or Inactive (IA)	Material Stored
Base Support Tanks (Continued)					
1001	1	500	A	A	Diesel Fuel
2001	1	1,000	B	A	Fuel Oil
2001	1	200	A	A	Diesel Fuel
3000	1	200	B	A	Diesel Fuel
3010	1	35	A	A	Diesel Fuel
3239	1	35	A	A	Diesel Fuel
4003	1	35	A	A	Diesel Fuel
4101	1	200	B	A	Diesel Fuel
4116	1	25,000	A	A	Demineralized Water
4127	1	4,000	B	A	Diesel Fuel
4201	1(2)	<35(3)	A	A	Diesel Fuel
4314	1	10,000	B	A	Diesel Fuel
4322	1	2,000	B	A	Diesel Fuel
4322	1	2,000	B	A	JP-4
4322	1	2,000	B	A	MOGAS
5001	4(2)	400(3)	A	A	Diesel Fuel
5020	1	10,000	B	A	Diesel Fuel
5202	1(2)	<35(3)	A	A	Diesel Fuel
5230	6	2,200	A	A	Waste Fuel
5401	1	107(3)	A	A	Diesel Fuel
5402	1	107(3)	A	A	Diesel Fuel
5403	1	107(3)	A	A	Diesel Fuel
5404	1	107(3)	A	A	Diesel Fuel
5405	1	50,000	B	A	De-Icing

TABLE D.1 (Continued)
LIQUID FUEL AND OTHER PRODUCT TANKS
DYESS AFB

Facility No.	No. Tanks	Total Capacity (gallons)	Above (A) or Below (B) Ground	Active (A) or Inactive (IA)	Material Stored
Base Support Tanks (Continued)					
5405	1	107[3]	A	A	Diesel Fuel
5410	1	200	B	A	Diesel Fuel
6015	1[2]	<35[3]	A	A	Diesel Fuel
6221	1[2]	<35[3]	A	A	Diesel Fuel
7007	1[2]	<35[3]	A	A	Diesel Fuel
7101	1	500	B	A	Waste Oil
7216	1[2]	<35[3]	A	A	Diesel Fuel
7318	1	45[3]	A	A	Diesel Fuel
7325	1	500	B	A	Waste Oil
7325	1	10,000	B	A	MOGAS
7325	3	24,000	B	A	MOGAS
8006	1[2]	<35[3]	A	A	Diesel Fuel
8014	5	50,000	B	A	MOGAS
8014	1	15,000	B	A	Diesel Fuel
8018	1	10,000	B	A	Waste Fuel
8030	1	600	B	A	Diesel Fuel
9001	1	250	B	A	MOGAS
9005	1	107[3]	A	A	Diesel Fuel
9007	1	25,250	B	A	MOGAS
9008	1	15,000	B	A	MOGAS
9009	1	15,000	B	A	Diesel Fuel
9013	1	25,250	B	A	MOGAS
9014	1	50,000	B	IA	--
9030	1	300	B	A	Diesel Fuel
9114	1	4,000	B	A	Diesel Fuel
9114	1	4,000	B	A	Diesel Fuel

TABLE D.1 (Continued)
LIQUID FUEL AND OTHER PRODUCT TANKS
DYESS AFB

Facility No.	No. Tanks	Total Capacity (gallons)	Above (A) or Below (B) Ground	Active (A) or Inactive (IA)	Material Stored
Base Support Tanks (Continued)					
9201	1	2,000	B	IA	MOGAS
9201	1	1,000	B	A	Diesel Fuel
9202	2	32,000	B	A	Fuel Oil
(4)	1	10,000	A	IA	Liquid Wastes

(1) All inactive tanks are pickled except the buried railroad tank car.

(2) Mobile tanks.

(3) Unit tanks mounted on diesel engine.

(4) Buried railroad tank car near grenade range and landfill.

Source: Installation documents.

TABLE D.2
PESTICIDES CURRENTLY USED
AT DYESS AFB

Insecticides	Fungicides	Herbicides
Isofenphous	Chloroneb	Pramitol 25E
Mocap	Daconil	Pramitol 5PS
Diazinon	Iprodione	Atrazine 80W
Dursban 2E	Triademefon	Dalpon-M
Dursban 1/2G	Methyl throphamate	Maintain CF-135
Pyrethrum		
Carbaryl		
Malathion		
Sevin		
Gold Crest C-100		
Baygon		

Source: Pest Management Plan

TEXAS SURFACE WATER QUALITY STANDARDS

FRESH AND TIDAL WATERS

BRAZOS RIVER BASIN		WATER USES DEEMED DESIRABLE				CRITERIA						
SEGMENT											COLIFORM	
NUMBER	DESCRIPTION	CONTACT RECREATION	NONCONTACT RECREATION	PROPAGATION OF FISH & WILDLIFE	DOMESTIC RAW WATER SUPPLY	CHLORIDE (mg/l) avg. not to exceed	SULFATE (mg/l) avg. not to exceed	TOTAL DISSOLVED SOLIDS (mg/l) avg. not to exceed	DISSOLVED OXYGEN (mg/l) not less than	pH RANGE	FECAL/ (100 ml)— log. avg. not more than (see Gen. Statement)	TEMPERATURE °F (see Gen. Statement)
1233	Hubbard Creek Reservoir	X	X	X	X	350	75	750	5.0	6.5–9.0	200	93
1234	Lake Cisco	X	X	X	X	75	75	350	5.0	6.5–9.0	200	93
1235	Lake Stamford	X	X	X	X	425	350	1,100	5.0	6.5–9.0	200	93
1236	Lake Fort Phantom Hill	X	X	X	X	200	100	600	5.0	6.5–9.0	200	93
1237	Lake Sweetwater	X	X	X	X	175	225	500	5.0	6.5–9.0	200	93
1238	Salt Fork of Brazos River	X	X	X		23,000	4,000	40,000	5.0	6.5–9.0	200	93
1239	White River—Salt Fork Brazos River confluence to White River Dam	X	X	X	X	100	100	500	5.0	6.5–9.0	200	92
1240	White River Lake	X	X	X	X	150	100	450	5.0	6.5–9.0	200	89

Source: Texas Administrative Code: 1984

APPENDIX E

MASTER LIST OF SHOPS

APPENDIX E
MASTER LIST OF SHOPS

Name	Present Location	Handles Hazardous Materials*	Generates Hazardous Wastes*	Typical TSD Methods
96th Bombardment Wing (BMW)				
Aircrew Life Support	5016	Yes	No	Consumed in Process
96th Avionics Maintenance Squadron (AMS)				
Communications/Radio	5005	Yes	No	Consumed in Process
Navigations/Radar	5005	Yes	No	Consumed in Process
Defensive Avionics	5005	Yes	Yes	DPDO
Inertial Navigations (Doppler)	5005	Yes	No	Consumed in Process
Instruments	5005	Yes	No	Consumed in Process
Bomb Navigation	5005	Yes	No	Consumed in Process
Fire Control	5005	Yes	Yes	DPDO
PMEL-TMDE	7008	Yes	Yes	DPDO
Auto Flight Control	5005	Yes	No	Consumed in Process

* See page 4-2 and Appendix I for hazardous and potentially hazardous wastes included.

APPENDIX E
MASTER LIST OF SHOPS
(Continued)

Name	Present Location	Handles Hazardous Materials*	Generates Hazardous Wastes*	Typical TSD Methods
96th Field Maintenance Squadron (FMS)				
Machine Shop	8130	Yes	No	Consumed in Process
Metal Processing	8131	Yes	No	Consumed in Process
Structural Repair	8130	Yes	No	Consumed in Process
Corrosion Control	5003	Yes	Yes	DPDO/Sanitary Sewer/Off Base Contractor
Survival Equipment	8023	Yes	No	Consumed in Process
NDI	5004	Yes	Yes	DPDO/Sanitary Sewer
Propulsion (Engine)	4311	Yes	Yes	DPDO
Engine Test Cell	5305	Yes	Yes	DPDO/FPTA
Repair/Reclamation and Wheel and Tire	5020	Yes	Yes	DPDO
Fuel Systems	4314	Yes	Yes	Recycled/FPTA
Electrical Systems	4309	Yes	Yes	Sanitary Sewer/ DPDO
Pneudraulics	4309	Yes	Yes	DPDO
Environmental Systems	4309	Yes	No	Consumed in Process
Egress	5020	No	No	---
AGE	4314	Yes	Yes	DPDO/Storm Sewer

* See page 4-2 and Appendix I for hazardous and potentially hazardous wastes included.

APPENDIX E
MASTER LIST OF SHOPS
(Continued)

Name	Present Location	Handles Hazardous Materials*	Generates Hazardous Wastes*	Typical TSD Methods
96th Munitions Maintenance Squadron (MMS)				
Weapons Release	8040	Yes	No	Consumed in Process
Nuclear Maintenance	9110	Yes	Yes	DPDO
Conventional Maintenance	9113	Yes	Yes	DPDO
Explosive Ordnance Disposal	9115	Yes	Yes	Burn and Burial Area
Missile Checkout	9112	Yes	Yes	DPDO
SRAM Maintenance	9112	Yes	Yes	DPDO
VACE	9119	Yes	No	Consumed in Process
Equipment Maintenance	5204	Yes	Yes	Oil-Water Separator/ Sanitary Sewer
96th Organizational Maintenance Squadron (OMS)				
Nonpowered AGE	5121	Yes	Yes	DPDO
Transient Aircraft	9001	Yes	Yes	DPDO/FPTA
96th Supply Squadron (SUP)				
Fuels Laboratory	4116	Yes	No	Reused

* See page 4-2 and Appendix I for hazardous and potentially hazardous wastes included.

APPENDIX E
MASTER LIST OF SHOPS
(Continued)

Name	Present Location	Handles Hazardous Materials*	Generates Hazardous Wastes*	Typical TSD Methods
96th Transportation Squadron (TRANS)				
Packing and Crating	7008	No	No	---
Vehicle Maintenance	8015	Yes	Yes	DPDO/Sanitary Sewer
Fire Truck Maintenance	4003	Yes	Yes	DPDO/Sanitary Sewer
Refueling Maintenance	4116	Yes	Yes	DPDO/Sanitary Sewer/FPTA
Allied Trades	8015	Yes	Yes	DPDO
96th Combat Support Group (CSG)				
Reprographics	7316	Yes	No	Consumed in Process
Small Arms Training	8120	Yes	No	Consumed in Process
Photo Laboratory	7312	Yes	Yes	Silver Recovery/ Sanitary Sewer
Auto Hobby Shop	7101	Yes	Yes	Off Base Contractor

* See page 4-2 and Appendix I for hazardous and potentially hazardous wastes included.

APPENDIX E
MASTER LIST OF SHOPS
(Continued)

Name	Present Location	Handles Hazardous Materials*	Generates Hazardous Wastes*	Typical TSD Methods
96th Civil Engineering Squadron (CES)				
Fire Protection	4003	Yes	No	Consumed in Process
Pavements & Grounds	8050	Yes	No	Consumed in Process
Protective Coating (Paint)	8007	Yes	Yes	DPDO
Plumbing	8006	Yes	No	Consumed in Process
Metal Working	8006	Yes	No	Consumed in Process
Carpentry & Masonry	8007	No	No	---
Heating	8006	Yes	No	Consumed in Process
Refrigeration	8008	Yes	Yes	Ground/Sanitary Sewer
Liquid Fuels Maintenance	4116	Yes	Yes	Ground (Weathered)
Exterior Electrical	8008	Yes	Yes	DPDO
Power Production	8008	Yes	Yes	DPDO/Sanitary Sewer/FPTA
Water and Waste	8215	Yes	No	Consumed in Process
Entomology	8009	Yes	Yes	Off Base Contractor
Golf Course Maintenance	11975	Yes	Yes	DPDO

* See page 4-2 and Appendix I for hazardous and potentially hazardous wastes included.

APPENDIX E
MASTER LIST OF SHOPS
(Continued)

Name	Present Location	Handles Hazardous Materials*	Generates Hazardous Wastes*	Typical TSD Methods
USAF Hospital Dyess				
Radiology	9201	Yes	Yes	Silver Recovery/ Sanitary Sewer
Clinical Laboratory	9201	Yes	No	Consumed in Process
Surgery	9201	Yes	No	Consumed in Process
Dental Clinic	6133	Yes	Yes	Silver Recovery/ Sanitary Sewer
463rd Tactical Airlift Wing (MAC-Tenant)				
463rd Avionics Maintenance Squadron (AMS)				
Communications (Radio)	5005	Yes	No	Consumed in Process
Communications (Radar)	4309	Yes	No	Consumed in Process
Auto Flight Control	4309	Yes	No	Consumed in Process
Instruments	4309	Yes	No	Consumed in Process
Electrical Systems	4309	Yes	No	Consumed in Process
Communications (Doppler)	4309	Yes	No	Consumed in Process

* See page 4-2 and Appendix I for hazardous and potentially hazardous wastes included.

APPENDIX E
MASTER LIST OF SHOPS
(Continued)

Name	Present Location	Handles Hazardous Materials*	Generates Hazardous Wastes*	Typical TSD Methods
463rd Field Maintenance Squadron (FMS)				
Machine Shop	8130	Yes	No	Consumed in Process
Metal Processing	8131	Yes	No	Consumed in Process
Structural Repair	8130	Yes	No	Consumed in Process
Corrosion Control	5003	Yes	Yes	DPDO/Sanitary Sewer/Off Base Contractor
Survival Equipment	8023	Yes	No	Consumed in Process
Propulsion (Engine/ Propeller)	4311	Yes	Yes	DPDO/FPTA/ Sanitary Sewer
Engine Test Cell	5300	Yes	Yes	DPDO
Repair/Reclamation and Wheel and Tire	5020	Yes	Yes	DPDO
Fuel Systems	4314	Yes	Yes	DPDO
Pneudraulics	5020	Yes	Yes	DPDO
Environmental Systems	5020	Yes	No	Consumed in Process
Refurb Hangar	5017	Yes	Yes	DPDO
AGE	4314	Yes	Yes	DPDO/Storm Sewer

* See page 4-2 and Appendix I for hazardous and potentially hazardous wastes included.

APPENDIX E
MASTER LIST OF SHOPS
(Continued)

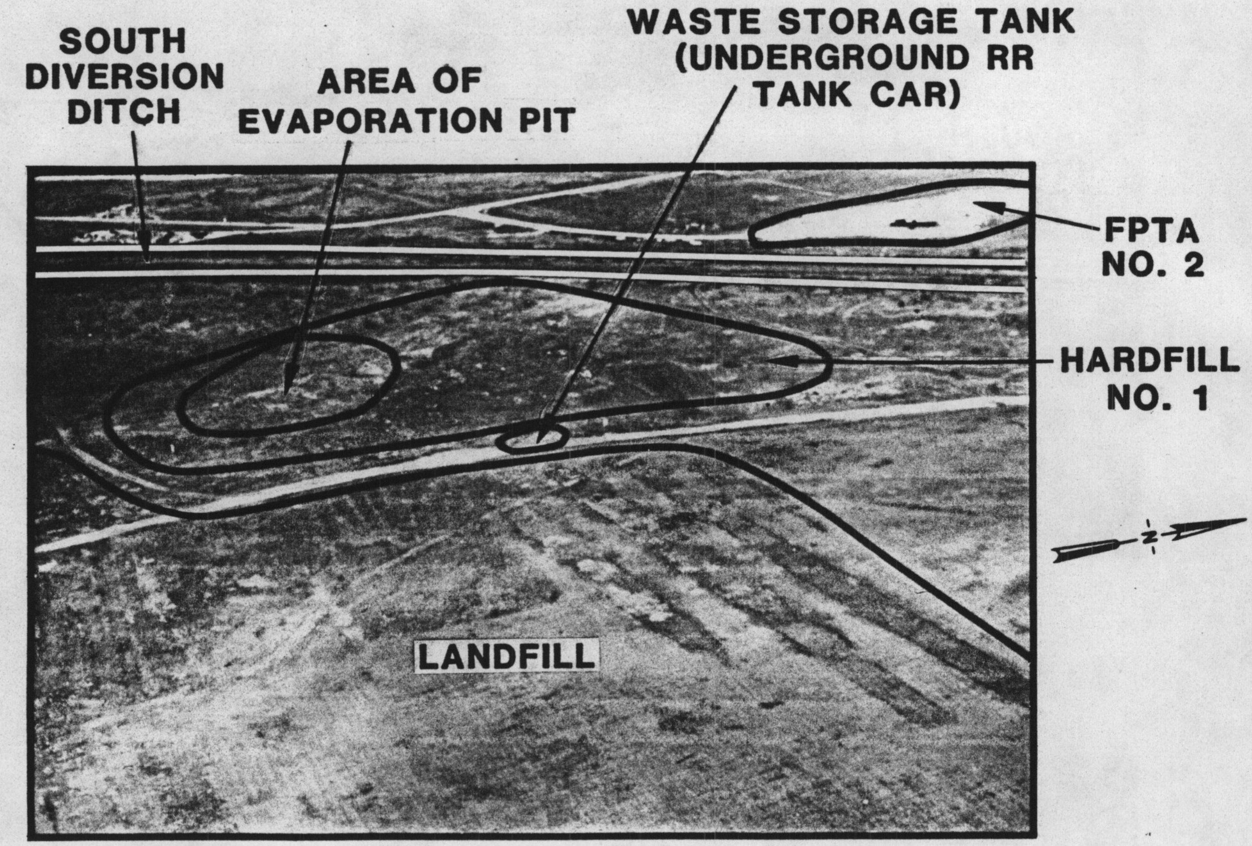
Name	Present Location	Handles Hazardous Materials*	Generates Hazardous Wastes*	Typical TSD Methods
463rd Organizational Maintenance Squadron (OMS)				
Nonpowered AGE	4318	Yes	Yes	DPDO/Reused/ FPTA
Washrack	4222	No	No	---
1st Mobile Aerial Port Squadron (MAPS)				
Vehicle Maintenance	4314	Yes	Yes	DPDO
Carpenter Shop	4314	No	No	---
Detachment 1, 47th Field Training Wing (ACE)				
Flight Maintenance (T-38)	5015	Yes	Yes	DPDO
1993rd Information Systems Squadron (ISS)				
Navigation Aids Maintenance	7008	Yes	Yes	DPDO/Sanitary Sewer
Weather Maintenance	9042	Yes	No	Consumed in Process
Army and Air Force Exchange Service				
BX Service Station	7325	Yes	Yes	Off Base Contractor

* See page 4-2 and Appendix I for hazardous and potentially hazardous wastes included.

APPENDIX F

PHOTOGRAPHS

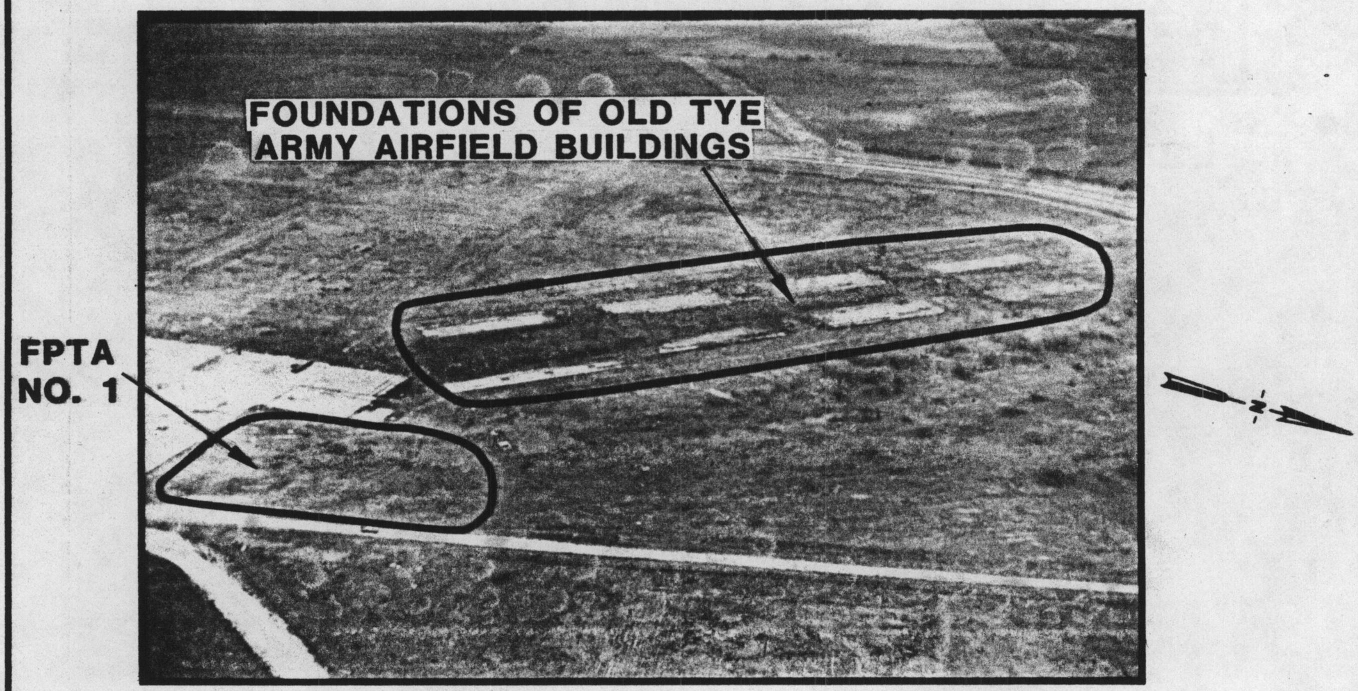
DYESS AFB



Landfill, Evaporation Pit, Waste Storage Tank (underground RR tank car), Hardfill No. 1, FPTA No. 2 and South Diversion Ditch

DYESS AFB

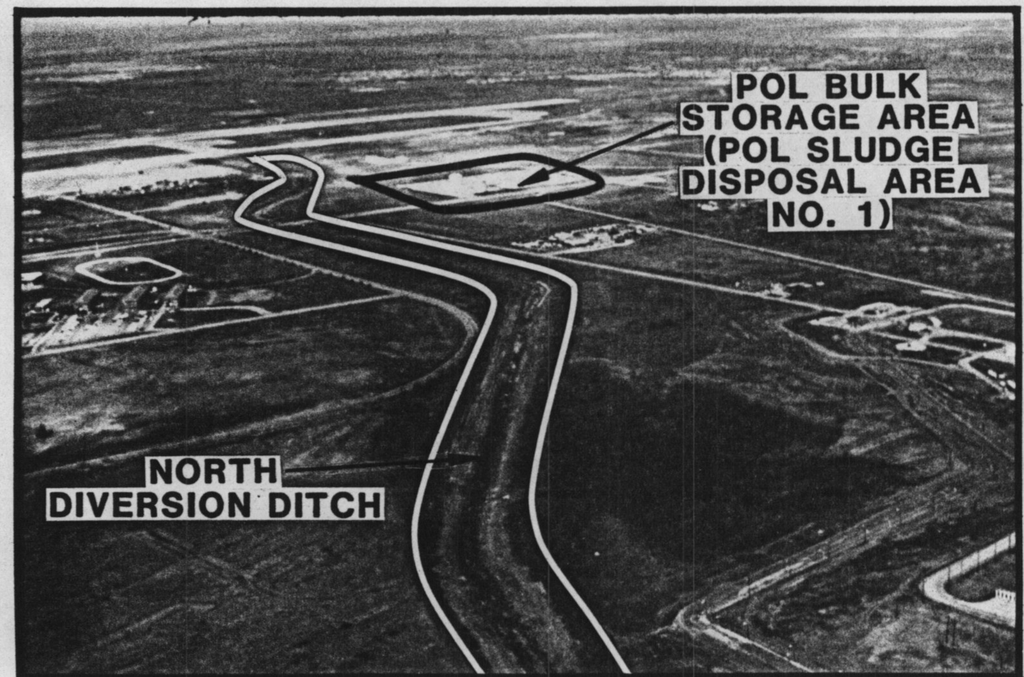
FPTA No. 2, Hardfill No. 1 and
South Diversion Ditch



FPTA No. 1

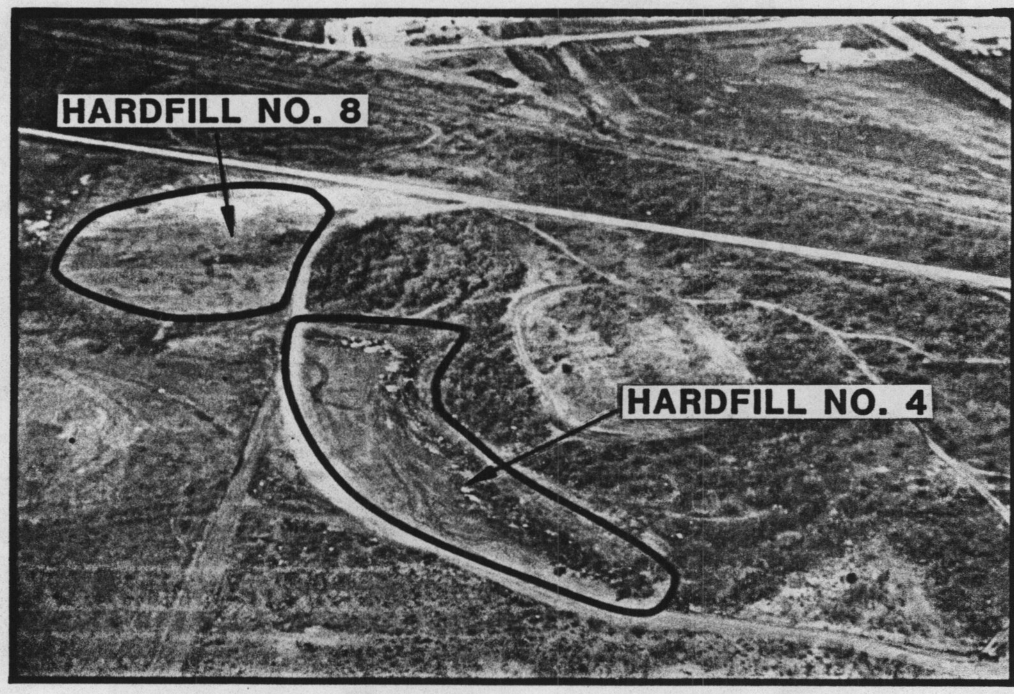
DYESS AFB

EOD Burial Site No. 1

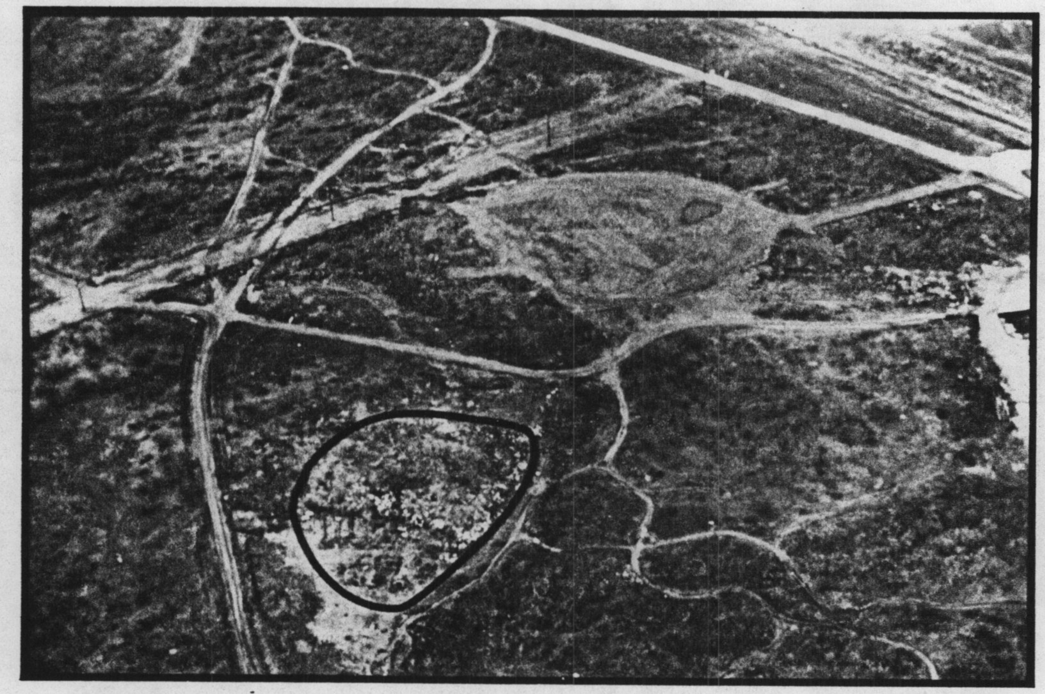


POL Bulk Storage Area and
North Diversion Ditch

DYESS AFB



Hardfill Nos. 4 and 8



Hardfill No. 7

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM

HAZARD ASSESSMENT RATING METHODOLOGY

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM
HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

The Department of Defense (DOD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DOD facilities. One of the actions required under this program is to:

> "develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts." (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Records Search phase of its Installation Restoration Program (IRP).

The first site rating model was developed in June 1981 at a meeting with represenatives from USAF Occupational and Environmental Health Laboratory (OEHL), Air Force Engineering and Services Center (AFESC), Engineering-Science (ES) and CH2M Hill. The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for 6 months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of USAF OEHL, AFESC, various major commands, Engineering-Science, and CH2M Hill met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air Force in setting priorities for follow-on site investigations and confirmation work under Phase II of the IRP.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DOD program needs.

The model uses data readily obtained during the Records Search portion (Phase I) of the IRP. Scoring judgments and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards at the site. This approach meshes well with the policy for evaluating and setting restrictions on excess DOD properties.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: the possible receptors of the contamination, the waste and its characteristics, potential pathways for waste contaminant migration, and any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant and adding the weighted scores to obtain a total category score.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among three possible routes is used. These routes are surface water migration, flooding, and ground-water migration. Evaluation of each route involves factors associated with the particular migration route. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The scores for each of the three categories are then added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Sites at which there is no containment are not reduced in score. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.

HAZARD ASSESSMENT RATING METHODOLOGY FLOW CHART

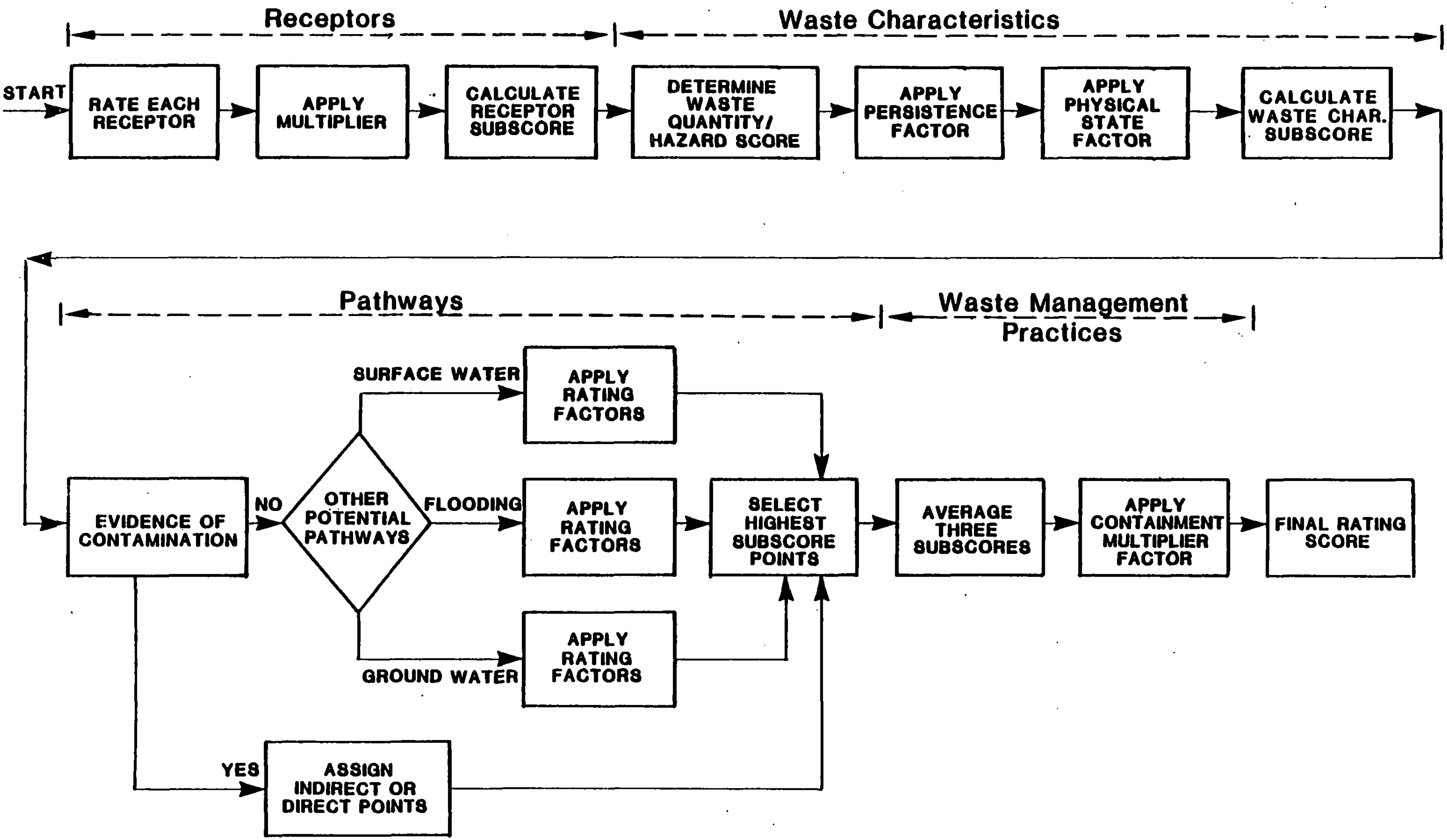


FIGURE 1

FIGURE 2

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE ________________________________

LOCATION ________________________________

DATE OF OPERATION OR OCCURRENCE ________________________________

OWNER/OPERATOR ________________________________

COMMENTS/DESCRIPTION ________________________________

SITE RATED BY ________________________________

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to reservation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site		6		
I. Population served by ground-water supply within 3 miles of site		6		
		Subtotals	______	______

Receptors subscore (100 X factor score subtotal/maximum score subtotal) ______

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ______
2. Confidence level (C = confirmed, S = suspected) ______
3. Hazard rating (H = high, M = medium, L = low) ______

Factor Subscore A (from 20 to 100 based on factor score matrix) ______

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		
Subtotals			______	______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding		1		

Subscore (100 x factor score/3) ______

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		3		
Subsurface flows		8		
Direct access to ground water		8		
Subtotals			______	______

Subscore (100 x factor score subtotal/maximum score subtotal) ______

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ X ______ = ______

TABLE 1

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1 - 25	26 - 100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1 mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1 mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination.	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands.	10
F. Water quality/use designation of nearest surface water body	Agricultural or industrial use.	Recreation, propagation and management of fish and wildlife.	Shellfish propagation and harvesting.	Potable water supplies	6
G. Ground-Water use of uppermost aquifer	Not used, other sources readily available.	Commercial, industrial, or irrigation, very limited other water sources.	Drinking water, municipal water available.	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available.	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1 - 50	51 - 1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1 - 50	51 - 1,000	Greater than 1, 000	6

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (<5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (>20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records.
- o Knowledge of types and quantities of wastes generated by shops and other areas on base.
- o Based on the above, a determination of the types and quantities of waste disposed of at the site.

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records.
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site.

A-3 Hazard Rating

Hazard Category	Rating Scale Levels 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:
Confidence Level
- o Confirmed confidence levels (C) can be added
- o Suspected confidence levels (S) can be added
- o Confirmed confidence levels cannot be added with suspected confidence levels

Waste Hazard Rating
- o Wastes with the same hazard rating can be added
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 POTENTIAL FOR SURFACE WATER CONTAMINATION

Rating Factor	Rating Scale Levels 0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 in.	-10 to + 5 in.	+5 to +20 in.	Greater than +20 in.	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1 year 24-hr rainfall	<1.0 inch	1.0-2.0 inches	2.1-3.0 inches	>3.0 inches	8

B-2 POTENTIAL FOR FLOODING

Rating Factor	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 25-year floodplain	In 10-year floodplain	Floods annually	1

B-3 POTENTIAL FOR GROUND-WATER CONTAMINATION

Rating Factor	0	1	2	3	Multiplier
Depth to ground water	Greater than 500 ft	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 in.	-10 to +5 in.	+5 to +20 in.	Greater than +20 in.	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casings, subsidence fissures,	No evidence of risk	Low risk	Moderate risk	High risk	8

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. WASTE MANAGEMENT PRACTICES FACTOR

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Fire Proection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1 or III-B-3, then leave blank for calculation of factor score and maximum possible score.

APPENDIX H

SITE HAZARD ASSESSMENT RATING FORMS

APPENDIX H

INDEX FOR HAZARD ASSESSMENT

METHODOLOGY FORMS

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Evaporation Pit / Waste Storage Tank
Location: East of South Diversion Ditch near Grenade Range
Date of Operation: 1950's or 1960's to late 1970's
Owner/Operator: Dyess AFB
Comments/Description: Storage and disposal of oils , hydraulic fluids , solvents , etc.
Site Rated by: R.L.Thoem and J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			94	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 52

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) L = large
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.90 = 90

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

90 x 1.00 = 90

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			46	108
Subscore (100 x factor score subtotal/maximum score subtotal)				43
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			32	114
Subscore (100 x factor score subtotal/maximum score subtotal)				28

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	52	
Waste Characteristics	90	
Pathways	43	
Total 185 divided by 3 =		62 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

62 x 1.00 = 62

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: North Diversion Ditch
Location: Northeastern part of the base
Date of Operation: 1955 to present
Owner/Operator: Dyess AFB
Comments/Description: Run-off from flightline spills, POL bulk storage area spills, aircraft washrack and some uncontrolled shop wastes
Site Rated by: R.L.Thoem and J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			95	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 53

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) L = large
2. Confidence level (confirmed or suspected) S = suspected
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 70

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

70 x 0.80 = 56

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

56 x 1.00 = 56

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	N/A	8	0	0
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
Subtotals			44	84
Subscore (100 x factor score subtotal/maximum score subtotal)				52
2. Flooding	N/A	1	0	N/A
Subscore (100 x factor score/3)				N/A
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	1	8	8	24
Direct access to ground water	1	8	8	24
Subtotals			48	114
Subscore (100 x factor score subtotal/maximum score subtotal)				42

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 52

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	53	
Waste Characteristics	56	
Pathways	52	
Total 161 divided by 3 =		54 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

54 x 1.00 = 54

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Fire Protection Training Area No.2
Location: Adjacent to South Diversion Ditch
Date of Operation: 1967 to present
Owner/Operator: Dyess AFB
Comments/Description: Burned predominantly clean fuels but some contaminated fuels and oils and paint shop wastes
Site Rated by: R.L.Thoem and J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			91	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 51

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.80 = 64

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

64 x 1.00 = 64

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			54	108
Subscore (100 x factor score subtotal/maximum score subtotal)				50
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			32	114
Subscore (100 x factor score subtotal/maximum score subtotal)				28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 50

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	51
Waste Characteristics	64
Pathways	50
Total 165 divided by 3 =	55 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

55 x 0.95 = 52

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Fire Protection Training Area No.1
Location: West of runway near north end of Assault Landing Strips
Date of Operation: 1956 to 1967
Owner/Operator: Dyess AFB
Comments/Description: Burned waste fuels, thinners, paints, and oils

Site Rated by: R.L.Thoem and J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	0	10	0	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	0	6	0	18
Subtotals			52	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 29

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.80 = 64

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

64 x 1.00 = 64

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
Subtotals			60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors			29	
Waste Characteristics			64	
Pathways			56	
Total	149	divided by 3 =		50 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

50 x 1.00 = \ 50 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Landfill / POL Sludge Disposal Area No.2
Location: East of South Diversion Ditch at present Grenade Range
Date of Operation: Landfill 1955 to 1972; Sludge Disposal 1967 to 1978
Owner/Operator: Dyess AFB
Comments/Description: Disposal of POL tank cleaning sludge , paint sludge and small amounts of shop wastes
Site Rated by: R.L.Thoem and J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			97	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 54

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.80 = 64

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

64 x 0.75 = 48

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			46	108
Subscore (100 x factor score subtotal/maximum score subtotal)				43
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			32	114
Subscore (100 x factor score subtotal/maximum score subtotal)				28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		54		
Waste Characteristics		48		
Pathways		43		
Total	144	divided by 3 =	48	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

48 x 1.00 = \ 48 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: South Diversion Ditch
Location: Southeastern part of the base
Date of Operation: 1955 to present
Owner/Operator: Dyess AFB
Comments/Description: Run-off from flightline spills and engine test areas and some uncontrolled shop wastes
Site Rated by: R.L.Thoem and J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			95	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 53

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) S = suspected
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 50

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

50 x 0.80 = 40

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

40 x 1.00 = 40

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	N/A	8	0	0
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			38	84
Subscore (100 x factor score subtotal/maximum score subtotal)				45
2. Flooding	N/A	1	0	0
Subscore (100 x factor score/3)				N/A
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	1	8	8	24
Direct access to ground water	1	8	8	24
Subtotals			56	114
Subscore (100 x factor score subtotal/maximum score subtotal)				49

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 49

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		53	
Waste Characteristics		40	
Pathways		49	
Total	142	divided by 3 =	47 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

47 x 1.00 = 47

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: POL Sludge Disposal Area No.1
Location: Adjacent to bermed POL bulk storage tanks
Date of Operation: 1958 to 1967
Owner/Operator: Dyess AFB
Comments/Description: Disposal of POL tank cleaning sludges

Site Rated by: R.L.Thoem and J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			81	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 45

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.80 = 48

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 0.75 = 36

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
Subtotals			60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		45	
Waste Characteristics		36	
Pathways		56	
Total	137	divided by 3 =	46 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

46 x 1.00 = \ 46 \

FINAL SCORE

APPENDIX I

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

APPENDIX I

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

ABG: Air Base Group.

ACE: Accelerated Co-pilot Enrichment

AF: Air Force.

AFB: Air Force Base.

AFESC: Air Force Engineering and Services Center.

AFFF: Aqueous Film Forming Foam, a fire extinquishing agent. AFFF concentrates include fluorinated surfactants plus foam stabilizers diluted with water to a 3 to 6% solution.

AFR: Air Force Regulation.

AFRCE: Air Force Regional Civil Engineer.

Ag: Chemical symbol for silver.

AGE: Aerospace Ground Equipment.

Al: Chemical symbol for aluminum.

ALLUVIUM: Materials eroded, transported and deposited by streams.

ALLUVIAL FAN: A fan-shaped deposit formed by a stream either where it issues from a narrow mountain valley into a plain or broad valley, or where a tributary stream joins a main stream.

AMS: Avionics Maintenance Squadron

ANTICLINE: A fold in which layered strata are inclined down and away from the axes.

AROMATIC: Description of organic chemical compounds in which the carbon atoms are arranged into a ring with special electron stability associated. Aromatic compounds are often more reactive than non-aromatics.

ARTESIAN: Ground water contained under hydrostatic pressure.

AQUICLUDE: Poorly permeable formation that impedes ground-water movement and does not yield to a well or spring.

AQUIFER: A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.

AQUITARD: A geologic unit which impedes ground-water flow.

AVGAS: Aviation Gasoline.

Ba: Chemical symbol for barium.

BEDROCK: Any solid rock exposed at the surface of the earth or overlain by unconsolidated material.

BEE: Bioenvironmental Engineer.

BES: Bioenvironmental Engineering Section.

BIOACCUMULATE: Tendency of elements or compounds to accumulate or build up in the tissues of living organisms when they are exposed to these elements in their environments, e.g., heavy metals.

BIODEGRADABLE: The characteristic of a substance to be broken down from complex to simple compounds by microorganisms.

BMW: Bombardment Wing

BOWSER: A portable tank, usually under 200 gallons in capacity.

BX: Base Exchange.

$CaCO_3$: Chemical symbol for calcium carbonate.

CALICHE: A soil type composed of soluble calcium salt crusts with sand, gravel, silt or clay. It occurs as a cemented layer in semiarid and subhumid climates on or near ground surface.

Cd: Chemical symbol for cadmium.

CE: Civil Engineering.

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act.

CES: Civil Engineering Squadron.

CIRCA: About; used to indicate an approximate date.

CLOSURE: The completion of a set of rigidly defined functions for a hazardous waste facility no longer in operation.

CN: Chemical symbol for cyanide.

COASTAL PLAINS: Physiographic province of the Eastern United States characterized by a gently seaward sloping surface formed over exposed, unconsolidated, stratified marine fluvial sediments. Typical coastal plain features include low hills and ridges, organic deposits, flood-plains and high water tables.

COD: Chemical Oxygen Demand, a measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water.

COE: Corps of Engineers.

COLLUVIUM: Sediments that have moved down slope primarily under the influence of gravity or as periodic, unchannelized flow. It frequently includes large boulders or other fragments which contrast this matrial to alluvium, material deposited by channelized flow which results in some degree of sorting according to particle size.

CONFINED AQUIFER: An aquifer bounded above and below by impermeable strata or by geologic units of distinctly lower permeability than that of the aquifer itself.

CONFINING UNIT: An aquitard or other poorly permeable layer which restricts the movement of ground water.

CONTAMINATION: The degradation of natural water quality to the extent that its usefulness is impaired; there is no implication of any specific limits since the degree of permissible contamination depends upon the intended end use or uses of the water.

CONUS: Continental United States.

CPM: Counts per minute (alpha radiation measurement).

Cr: Chemical symbol for chromium.

CSG: Combat Support Group.

Cu: Chemical symbol for copper.

DEQPPM: Defense Environmental Quality Program Policy Memorandum

DET: Detachment.

DIP: The angle measured from the horizontal that a structural feature makes. Structural features may include bedding, folds, faults, etc. Dip is measured in degrees of the vertical plane, normal to strike.

DISPOSAL FACILITY: A facility or part of a facility at which hazardous waste is intentionally placed into or on land or water, and at which waste will remain after closure.

DISPOSAL OF HAZARDOUS WASTE: The discharge, deposit, injection, dumping, spilling, or placing of any hazardous waste into or on land or water so that such waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground water.

DOD: Department of Defense.

DOWNGRADIENT: In the direction of decreasing hydraulic static head; the direction in which ground water flows.

DPDO: Defense Property Disposal Office, previously included Redistribution and Marketing (R&M) and Salvage.

DUMP: An uncovered land disposal site where solid and/or liquid wastes are deposited with little or no regard for pollution control or aesthetics; dumps are susceptible to open burning and are exposed to the elements, disease vectors and scavengers.

EFFLUENT: A liquid waste discharge from a manufacturing or treatment process, in its natural state, or partially or completely treated, that discharges into the environment.

ELECTRICAL RESISTIVITY (ER): Specialized equipment designed to produce an electrical current through subsurface geologic strata. The instrument and the technique permit the operator to examine conditions at specific depths below land surface. Subsurface contrasts indicative of specific geologic or hydrologic conditions may be obtained through correlation of the ER data with known site information such as that provided by test borings or well construction logs.

EOD: Explosive Ordnance Disposal.

EP: Extraction Procedure, the EPA's standard laboratory procedure for leachate generation.

EPA: U.S. Environmental Protection Agency.

EPHEMERAL: Short-lived or temporary.

EPHEMERAL AQUIFER: A water-bearing zone typically located near the surface which normally contains water seasonally.

EROSION: The wearing away of land surface by wind, water, or chemical processes.

ES: Engineering-Science, Inc.

ESCARPMENT: A long, usually continuous cliff or relatively steep slope facing one general direction, breaking the continuity of the land by separating two level or gently sloping surfaces; produced by erosion or faulting.

FAA: Federal Aviation Administration.

FACILITY (As Applied to Hazardous Wastes): Any land and appurtenances thereon and thereto used for the treatment, storage and/or disposal of hazardous wastes.

FAULT: A fracture in rock along which the adjacent rock surfaces are differentially displaced.

Fe: Chemical symbol for iron.

FLOOD PLAIN: The lowland and relatively flat areas adjoining inland and coastal areas of the mainland and off-shore islands, including, at a minimum, areas subject to a one percent or greater chance of flooding in any given year.

FLOW PATH: The direction or movement of ground water as governed principally by the hydraulic gradient.

FMS: Field Maintenance Squadron.

FPTA: Fire Protection Training Area.

GC/MS: Gas chromatograph/mass spectrophotometer, a laboratory procedure for identifying unknown compounds.

GEOPHYSICS: (Geophysical survey) the use of one or more geophysical instruments or methods to measure specific properties of the earth's subsurface through indirect means. Geophysical equipment may include electrical resistivity, geiger counter, magnetometer, metal detector, electromagnetic conductivity, magnetic susceptibility, etc. Geophysics seeks to provide specific measurements of the earth's magnetic field, the electrical properties of specific geologic strata, radioactivity, etc.

GLACIAL TILL: Unsorted and unstratified drift consisting of clay, sand, gravel and boulders which is deposited by or underneath a glacier.

GLAUCOMITIC SAND AND GRAVEL: A mixture of sand, gravel and glaucomite, an iron-potassium silicate mineral which imparts a green color to the mixture. Glaucomite is geologically significant because it indicates slow sedimentation.

GLIDE-BLOCK: A large section of a geologic unit that has separated from the main portion of the unit due to earthquake/landslide-induced lateral movement.

GROUND WATER: Water beneath the land surface in the saturated zone that is under atmospheric or artesian pressure.

GROUND WATER RESERVOIR: The earth materials and the intervening open spaces that contain ground water.

HALF-LIFE: The time required for half the atoms present in radioactive substance to disintegrate.

HALOGEN: The class of chemical elements including fluorine, chlorine, bromine, and iodine.

HARDFILL: Disposal sites receiving construction debris, wood, miscellaneous spoil material.

HARM: Hazard Assessment Rating Methodology.

*HAZARDOUS SUBSTANCE: Under CERCLA, the definition of hazardous substance includes:

1. All substances regulated under Paragraphs 311 and 307 of the Clean Water Act (except oil);

2. All substances regulated under Paragraph 3001 of the Solid Waste Disposal Act;

3. All substances regulated under Paragraph 112 of the Clean Air Act;

4. All substances which the Administrator of EPA has acted against under Paragraph 7 of the Toxic Substance Control Act;

5. Additional substances designated under Paragraph 102 of CERCLA.

*HAZARDOUS WASTE: As defined in RCRA, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

HAZARDOUS WASTE GENERATION: The act or process of producing a hazardous waste.

HEAVY METALS: Metallic elements, including the transition series, which include many elements required for plant and animal nutrition in trace concentrations but which become toxic at higher concentrations.

Hg: Chemical symbol for mercury.

HQ: Headquarters.

HWAP: Hazardous Waste Accumulation Point.

* See page 4-2 for hazardous and potentially hazardous wastes considered in this study. Waste oil has been included in this category even though it is not designated by Texas or USEPA regulations.

HYDROCARBONS: Organic chemical compounds composed of hydrogen and carbon atoms chemically bonded. Hydrocarbons may be straight chain, cyclic, branched chain, aromatic, or polycyclic, depending upon arrangement of carbon atoms. Halogenated hydrocarbons are hydrocarbons in which one or more hydrogen atoms has been replaced by a halogen atom.

INCOMPATIBLE WASTE: A waste unsuitable for commingling with another waste or material because the commingling might result in generation of extreme heat or pressure, explosion or violent reaction, fire, formation of substances which are shock sensitive, friction sensitive, or otherwise have the potential for reacting violently, formation of toxic dusts, mists, fumes, and gases, volatilization of ignitable or toxic chemicals due to heat generation in such a manner that the likelihood of contamination of ground water or escape of the substance into the environment is increased, any other reaction which might result in not meeting the air, human health, and environmental standards.

INFILTRATION: The movement of water through the soil surface into the ground.

IRP: Installation Restoration Program.

ISOPACH: Graphic presentation of geologic data, including lines of equal unit thickness that may be based on confirmed (drill hole) data or indirect geophysical measurement.

ISS: Information Systems Squadron

JP-4: Jet Propulsion Fuel Number Four; contains both kerosene and gasoline fractions.

LANDFILL: A land disposal site used for disposing solid and semi-solid materials. May refer either to a sanitary landfill or dump.

LEACHATE: A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water.

LEACHING: The process by which soluble materials in the soil, such as nutrients, pesticide chemicals or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

LENTICULAR: A bed or rock stratum or body that is lens-shaped.

LINER: A continous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents or leachate.

LITHOLOGY: The description of the physical character of a rock.

LOESS: An essentially unconsolidated unstratified calcareous silt; commonly homogeneous, permeable and buff to gray in color.

m: Milli (10^{-3}).

MAC: Military Airlift Command.

MAGNETOMETER (MG): A device capable of measuring localized variations in the earth's magnetic field that may be due to disturbed areas such as backfilled trenches, buried objects, etc. Measurements may be obtained at points located on a grid pattern so that the data can be contoured, revealing the location, size and intensity of the suspected anomaly.

MAPS: Mobile Aerial Port Squadron

MEK: Methyl Ethyl Ketone.

METALS: See "Heavy Metals".

mgd: Million Gallons per Day.

MICRO: u (10^{-6})

ug/1: Micrograms per liter.

mg/l: Milligrams per liter.

MMS: Munitions Maintenance Squadron

MOGAS: Motor gasoline.

Mn: Chemical symbol for manganese.

MONITORING WELL: A well used to measure ground-water levels and to obtain ground-water samples for water quality analyses. As distinguished from observation wells, monitoring wells are often designed for longer term operations. They are constructed of materials for the site-specific climatic, hydrogeologic and contaminant conditions.

MSL: Mean Sea Level.

MUNITION ITEMS: Munitions or portions of munitions having an explosive potential.

MUNITIONS RESIDUE: Non-explosive segments of waste munitions (i.e., bomb casings).

MWR: Morale, Welfare and Recreation.

NCO: Non-commissioned Officer.

NCOIC: Non-commissioned Officer In-Charge.

NDI: Non-destructive Inspection.

NET PRECIPITATION: The amount of annual precipitation minus annual evaporation.

NGVD: National Geodetic Vertical Datum of 1929. A national datum system, tied to Mean Sea Level, but referenced primarily to land-based benchmarks.

Ni: Chemical symbol for nickel.

NOAA: National Oceanic and Atmospheric Administration.

NON-CALCAREOUS: Not bearing calcium carbonate ($CaCO_3$) a characteristic mineral of marine paleoenvironment.

NPDES: National Pollutant Discharge Elimination System.

OBSERVATION WELL: An informally designed cased well, open to a specific geologic unit or formation, designed to allow the measurement of physical ground-water properties within the zone or unit of interest. Observation wells are designed to permit the measurement of water levels and in-situ parameters such as ground-water (flow velocity and flow direction. Not to be confused with a monitoring well, a well designed to permit accurate ground-water quality monitoring. Monitoring wells are constructed of materials compatible with site-specific climatic, hydrogeologic and contaminant conditions. monitoring well installation and construction is planned to have minimal impacts on apparent ground-water quality and will often be for longer term operation compared with observation wells.

OEHL: USAF Occupational and Environmental Health Laboratory.

OIC: Officer-In-Charge.

OMS: Organizational Maintenance Squadron.

ORGANIC: Being, containing or relating to carbon compounds, especially in which hydrogen is attached to carbon.

OSI: Office of Special Investigations.

O&G: Symbols for oil and grease.

OUTCROP: Zone or area of exposure where a geologic unit or formation occurs at or near land surface. "Outcrop area" is an important factor in hydrogeologic studies as this zone usually corresponds to the point where significant recharge occurs. When this term is used as an intransitive verb: "Where the unit crops out....."

Pb: Chemical symbol for lead.

PCB: Polychlorinated Biphenyl; liquids used as a dielectrics in electrical equipment.

PD-680: Cleaning solvent; petroleum distillate, Stoddard solvent.

PERCHED WATER TABLE: A water table above a relatively impermeable zone underlain by unsaturated rocks of sufficient permeability to allow ground-water movement.

PERCOLATION: Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil.

PERMEABILITY: The relative rate of water flow through a porous medium. The USDA, Soil Conservation Service describes permeability qualitatively as follows:

very slow	<0.06	inches/hour
slow	0.06 to 0.2	inches/hour
moderately slow	0.2 to 0.6	inches/hour
moderate	0.6 to 2.0	inches/hour
moderately rapid	2.0 to 6.0	inches/hour
rapid	6.0 to 20	inches/hour
very rapid	>20	inches/hour

PERSISTENCE: As applied to chemicals, those which are very stable and remain in the environment in their original form for an extended period of time.

PESTICIDE: An agent used to destroy pests. Pesticides include such specialty groups as herbicides, fungicides, insecticides, etc.

pH: Negative logarithm of hydrogen ion concentration.

PHYSIOGRAPHY: A description of the features and phenomena of nature; same as physical geography or geomorphology.

pico: 10^{-12}

PL: Public Law.

PMEL: Precision Measurement Equipment Lab.

POL: Petroleum, Oils and Lubricants.

POLLUTANT: Any introduced gas, liquid or solid that makes a resource unfit for a specific purpose.

POLYCYCLIC COMPOUND: All compounds in which carbon atoms are arranged into two or more rings, usually aromatic in nature.

POTENTIALLY ACTIVE FAULT: A fault along which movement has occurred within the last 25-million years.

POTENTIOMETRIC SURFACE: The imaginery surface to which water in an artesian aquifer would rise in tightly screened wells penetrating it.

ppb: Parts per billion by weight.

ppm: Parts per million by weight.

PRECIPITATION: Rainfall.

QUATERNARY MATERIALS: The second period of the Cenozoic geologic era, following the Tertiary, and including the last 2-3 million years.

RCRA: Resource Conservation and Recovery Act.

RECEPTORS: The potential impact group or resource for a waste contamination source.

RECHARGE AREA: A surface area in which surface water or precipitation percolates through the unsaturated zone and eventually reaches the zone of saturation. Recharge areas may be natural or manmade.

RECHARGE: The addition of water to the ground-water system by natural or artificial processes.

RESISTIVITY: See Electrical Resistivity

RM: Resource Management.

SAC: Strategic Air Command.

SANITARY LANDFILL: A land disposal site using an engineered method of disposing solid wastes on land in a way that minimizes environmental hazards.

SAPROLITE: A residual soil retaining the physical appearance or former structure of the parent rock.

SATURATED ZONE: That part of the earth's crust in which all voids are filled with water.

SAX'S TOXICITY: A rating method for evaluating the toxicity of chemical materials.

SCS: U.S. Department of Agriculture Soil Conservation Service.

SEISMICITY: Pertaining to earthquakes or earth vibrations.

SLUDGE: The solid residue resulting from a manufacturing or wastewater treatment process which also produces a liquid stream. The residue which accumulates in liquid fuel storage tanks.

SOLID WASTE: Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923).

SPILL: Any unplanned release or discharge of a hazardous waste onto or into the air, land, or water.

STORAGE OF HAZARDOUS WASTE: Containment, either on a temporary basis or for a longer period, in such a manner as not to constitute disposal of such hazardous waste.

STRIKE: The compass direction or trend taken by a structural feature, such as bedding, folds, faults, etc. Strike is measured at a point when the specific feature intersects the topographic surface.

SUPS: Supply Squadron.

TCE: Trichloroethylene, a solvent and suspected carcinogen.

TDS: Total Dissolved Solids.

TECTONIC (ally): Said of or pertaining to the forces and resulting structural or deformational features evident in the earth's crust. Tectonics usually deals with the broad architecture of the earth's outer crust.

TMDE: Test Measurement and Diagnostic Equipment.

TOC: Total Organic Carbon.

TOXICITY: The ability of a material to produce injury or disease upon exposure, ingestion, inhalation, or assimilation by a living organism.

TRANS: Transportation Squadron.

TRANSMISSIVITY: The rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient.

TREATMENT OF HAZARDOUS WASTE: Any method, technique, or process including neutralization designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize the waste or so as to render the waste nonhazardous.

TSD: Treatment, storage or disposal sites/methods.

UPGRADIENT: In the direction of increasing hydraulic static head; the direction opposite to the prevailing flow of ground-water.

US: United States.

USAF: United States Air Force.

USAFSS: United States Air Force Security Service.

USDA: United States Department of Agriculture.

USFWS: United States Fish and Wildlife Service.

USGS: United States Geological Survey.

USMC: United States Marine Corps.

USN: United States Navy.

WATER TABLE: Surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

WETLAND: An area inundated or saturated by surface or groundwater at a frequency and duration sufficient to support vegetation typically adapted to saturated soil conditions.

WWTP: Wastewater Treatment Plant.

Zn: Chemical symbol for zinc.

APPENDIX J

REFERENCES

APPENDIX J
REFERENCES

Cronin, J. G., Follett, C. R., Shafer, G. H. and Rettman, P. L., 1963. Reconnaissance Investigation of the Ground-Water Resources of the Brazos River Basin, Texas. Texas Water Commission Bulletin 6310. Austin, Texas.

Dyess AFB, undated. Fish and Wildlife Management Plan for Dyess Air Force Base, Texas Initial Plan for the Period September 1984 to September 1989. Dyess AFB, Texas.

Freese & Nichols, Inc., 1978 Municipal Water System Analysis. Abilene, Texas.

Headquarters Strategic Air Command (HQ SAC), 1983. Environmental Assessment (EA) for the Proposed Beddown of B-1B Aircraft at Dyess AFB, Texas. HQ SAC, Offutt AFB, Nebraska.

Kier, R. S., Garner, L. E. and Brown, L. F., 1977. Land Resources of Texas. Texas Bureau of Economic Geology, Austin, Texas.

National Oceanographic and Atmospheric Administration (NOAA), 1983. Climatic Atlas of the United States. National Climatic Data Center, Asheville, North Carolina.

Rawson, Jack, 1967. Study and Interpretation of Chemical Quality of Surface Waters in the Brazos River Basin, Texas. Texas Water Development Board Report 55. Austin, Texas.

Sellards, E. H., Adkins, W. S. and Plummer, F. B., 1932 (reprinted 1981). The Geology of Texas, Volume I, Stratigraphy. The University of Texas Bulletin 3232. Austin, Texas.

Smith, Hoyt A., 1940. Records of Wells and Springs, Drillers' Logs and Water Analyses and Map Showing Locations of Wells and Springs. Texas State Board of Water Engineers, Austin, Texas.

TAB A-1, 1977. Environmental Narrative. Dyess AFB, Texas.

Taylor, Howard D., 1978. Occurrence, Quantity and Quality of Ground Water in Taylor County, Texas. Texas Department of Water Resources Report 224. Austin, Texas.

Texas Administrative Code (TAC), 1984. Surface Water Quality Standards. TAC Sections 333.11 - 333.21. Texas Department of Water Resources, Austin, Texas.

Texas Bureau of Economic Geology (TBEG), 1972. Geologic Atlas of Texas, Abiline Sheet. Scale 1:250,000. Austin, Texas.

U.S. Department of Agriculture, Soil Conservation Service (USDA, SCS), 1976. Soil Survey of Taylor County, Texas.

U.S. Department of Commerce, Weather Bureau, 1961. Rainfall Frequency Atlas of the United States. Technical Paper 40. National Climatic Data Center, Asheville, North Carolina.

U.S. Environmental Protection Agency (USEPA), 1978. Electrical Resistivity Evaluations at Solid Waste Disposal Facilities. USEPA Publication No. SW-729. Washington, D.C.

U.S. Environmental Protection Agency (USEPA), 1980. Procedures Manual for Ground-Water Monitoring at Solid Waste Disposal Facilities. USEPA Publication No. SW-611. Washington, D.C.

APPENDIX K

INDEX OF REFERENCES OF POTENTIAL CONTAMINATION SITES AT DYESS AFB

APPENDIX K

INDEX OF REFERENCES TO SITES WITH POTENTIAL

FOR ENVIRONMENTAL CONTAMINATION

AT DYESS AFB

Site	References (Page Number)
Evaporation Pit/Waste Storage Tank	5,6,7,4-24,4-30,5-1,5-2,6-3,6-4,6-6
North Diversion Ditch	5,6,8,4-3,4-27,4-28,4-30,5-1,5-2,6-3, 6-5,6-6
Fire Protection Training Area No. 2	5,6,8,4-18,4-30,5-1,5-2,5-3,6-5,6-6, 6-7
Fire Protection Training AREA NO. 1	5,6,8,4-18,4-30,5-2,5-3,6-5,6-6,6-7
Landfill/POL Sludge Disposal Area No. 2	5,6,7,4-16,4-21,4-30,5-2,5-3,6-3,6-4 6-6
South Diversion Ditch	5,6,4-3,4-27,4-28,4-30,5-2,5-3
POL Sludge Disposal Area No. 1	5,6,4-16,4-30,5-2,5-4